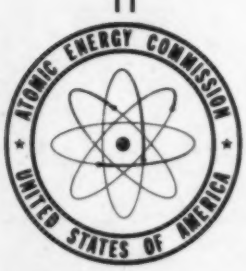
Sci. Rm.

4-NOV 26
Copy 7 1957

UNITED STATES ATOMIC ENERGY COMMISSION

# Nuclear Science Abstracts

Volume 11 No. 21
Abstracts 11830 - 12312
November 15, 1957




Technical Information Service Extension, Oak Ridge, Tenn.

# USAEC DEPOSITORY LIBRARIES

The libraries listed below maintain collections of unclassified U.S. Atomic Energy Commission reports for reference use by the general public. These depository collections are conveniently organized, and staff members of the libraries will assist requesters in the use of the collections. Each library will make copies of its AEC reports available to other libraries on interlibrary loans. All the libraries have facilities for making photocopies of reports that are not more conveniently available in printed form from the Office of Technical Services.

ALABAMA
- Birmingham, Birmingham Public Library

CALIFORNIA
- Berkeley, University of California General Library
- Los Angeles, University of California Library
- Menlo Park, Stanford Research Institute
- San Diego, San Diego Public Library

COLORADO
- Denver, Denver Public Library

CONNECTICUT
- New Haven, Yale University Library

DISTRICT OF COLUMBIA
- Washington, Library of Congress

FLORIDA
- Coral Gables, University of Miami Library
- Gainesville, University of Florida Library

GEORGIA
- Atlanta, Georgia Institute of Technology Library

ILLINOIS
- Chicago, John Crerar Library
- Chicago, University of Chicago Library
- Urbana, University of Illinois Library

INDIANA
- Indianapolis, Indianapolis Public Library
- Lafayette, Purdue University Library

IOWA
- Ames, Iowa State College Library

KENTUCKY
- Lexington, University of Kentucky Library
- Louisville, University of Louisville Library

LOUISIANA
- Baton Rouge, Louisiana State University Library
- New Orleans, Tulane University Library

MARYLAND
- Baltimore, Johns Hopkins University Library

MASSACHUSETTS
- Cambridge, Harvard University Library
- Cambridge, Massachusetts Institute of Technology Library

MICHIGAN
- Ann Arbor, University of Michigan Library
- Detroit, Detroit Public Library

MINNESOTA
- Minneapolis, University of Minnesota Library

MISSOURI
- Kansas City, Linda Hall Library
- St. Louis, Washington University Library

NEW JERSEY
- Princeton, Princeton University Library

NEW MEXICO
- Albuquerque, University of New Mexico Library

NEW YORK
- Buffalo, Lockwood Memorial Library
- Ithaca, Cornell University Library
- New York, Atomic Industrial Forum
- New York, Columbia University Library
- New York, New York Public Library
- Rochester, University of Rochester Library
- Troy, Rensselaer Polytechnic Institute Library

NORTH CAROLINA
- Charlotte, Charlotte and Mecklenburg County Public Library
- Durham, Duke University Library
- Raleigh, North Carolina State College Library

OHIO
- Cincinnati, University of Cincinnati Library
- Cleveland, Cleveland Public Library
- Columbus, Ohio State University Library
- Toledo, University of Toledo Library
- Youngstown, Youngstown University Library

OKLAHOMA
- Stillwater, Oklahoma Agricultural and Mechanical College Library

OREGON
- Corvallis, Oregon State College Library
- Portland, Portland Public Library

PENNSYLVANIA
- Philadelphia, University of Pennsylvania Library
- Pittsburgh, Carnegie Library of Pittsburgh
- University Park, Pennsylvania State University, Pattee Library

PUERTO RICO
- Rio Piedras, University of Puerto Rico, Main Library

RHODE ISLAND
- Providence, Brown University Library

SOUTH CAROLINA
- Columbia, University of South Carolina, McKissick Memorial Library

TENNESSEE
- Knoxville, University of Tennessee Library
- Memphis, Memphis Public Library
- Nashville, Joint University Libraries

TEXAS
- Austin, University of Texas Library
- Dallas, Southern Methodist University Library
- Houston, The Rice Institute Library
- San Antonio, San Antonio Public Library

UTAH
- Salt Lake City, University of Utah Library

VIRGINIA
- Blacksburg, Virginia Polytechnic Institute Library
- Charlottesville, University of Virginia, Alderman Library

WASHINGTON
- Seattle, University of Washington Library

WISCONSIN
- Madison, University of Wisconsin Library
- Milwaukee, Milwaukee Public Library

## DEPOSITORIES OF BRITISH REPORTS IN U.S. LIBRARIES

British reports (AERE series) currently issued are available at all the AEC depository libraries listed above. More complete sets of older reports are available at the following libraries:

CALIFORNIA
- Berkeley, University of California General Library

ILLINOIS
- Chicago, John Crerar Library

NEW YORK
- New York, New York Public Library

NORTH CAROLINA
- Durham, Duke University Library

## DEPOSITORIES OF CANADIAN REPORTS IN U.S. LIBRARIES

Canadian reports (AECL series) are available at the AEC depository libraries listed above.

# NUCLEAR SCIENCE ABSTRACTS

A Publication of the United States Atomic Energy Commission Technical Information Service.

The printing of this publication has been approved by the Director of the Bureau of the Budget July 30, 1957.

## INTRODUCTION

### SCOPE

*Nuclear Science Abstracts (NSA)* is intended primarily to serve scientists and engineers working within the Atomic Energy Project by abstracting as completely and as promptly as possible the literature of nuclear science and engineering. It covers not only unclassified and declassified research reports of the AEC and its contractors, but also material in its field of interest which appears in unpublished research reports of government agencies, universities, and industrial research establishments, and in the technical and scientific journals.

### INDEXES

*Nuclear Science Abstracts* is indexed by personal and corporate author, by subject, and by report number. Annual index issues are prepared for each volume. A cumulated index to Vols. 1–4 was issued as Vol. 4, No. 24B, Dec. 30, 1950.

### AVAILABILITY

*Nuclear Science Abstracts* is issued twice a month and is available in single copies (regular issues are 25 cents each and index issues are priced according to size, plus postage on all issues for foreign orders) or by subscription ($7.50 a year domestic, $9.50 a year foreign) from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

Change of address notices for subscriptions should be sent to the above address.

*Nuclear Science Abstracts* is also available on an exchange basis to universities, research institutions, industrial firms, and publishers of scientific information. The AEC invites inquiries from such organizations interested in exchanging publications.

Inquiries about exchanges and other official distribution, as well as change of address notices for official and exchange recipients, should be sent to the Technical Information Service Extension, U. S. Atomic Energy Commission, P. O. Box 62, Oak Ridge, Tenn.

### NEW NUCLEAR DATA

*Nuclear Science Abstracts* carries in issues 6B, 12B, and 18B lists of New Nuclear Data in which experimental results are displayed in tabular form and arranged by element and isotope, with each entry including a reference. An annual cumulation of New Nuclear Data is issued as a separate publication.

The lists of New Nuclear Data are compiled by the Nuclear Data Group of the National Research Council, Washington 25, D. C. The New Nuclear Data items are also supplied by this group on 3 × 5 inch cards for $15.00 a year, U.S. and Canada (1st class postage), elsewhere $15.00 (printed matter postage) or $19.00 (1st class postage).

### DECLASSIFICATION

The issuance of these abstracts does not constitute authority for declassification of any reports.

### RESEARCH AND DEVELOPMENT REPORTS

In general, only requesters associated with the U. S. Atomic Energy Program and with other government agencies, can obtain reports from the AEC or its contractors. Requesters not officially sponsored should not seek to obtain reports from the Commission or its contractors. Such requesters should obtain reports as described below.

Reports for Sale. The Office of Technical Services, Department of Commerce, Washington 25, D. C., is the sales agency for AEC unclassified reports although a small number of other AEC unclassified reports is available from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. The sales availability of each document is given in each abstract. The abstract numbers for each report can be found by consulting the Numerical Index of Reports at the back of each issue of *NSA*.

Price lists of the Office of Technical Services and of the Superintendent of Documents may be obtained upon request from these sales outlets. Reports should be ordered by report number and title. A check or money order made payable to the Treasurer of the United States should accompany each order. Foreign purchasers of reports, other than those in Canada and Mexico, should include an additional amount of postage, according to the scale that four pages approximate an ounce. It is the purchaser's responsibility to compute the necessary postage, as rates vary for different countries.

In addition to the full-scale copies of certain nonclassified AEC reports which are available from the Office of Technical Services, the Atomic Energy Commission has made contractual arrangements for the sale of microcopy of AEC reports with the following organizations:

Microcard Foundation
P. O. Box 2145
Madison 5, Wis.

Readex Microprint Corp.
100 Fifth Avenue
New York 11, N. Y.

Reports Available Elsewhere. Many of these reports will later appear in scientific and technical journals or in books. An appropriate citation is given in the Numerical Index of Reports and in the Cumulated Numerical List of Available Unclassified U. S. Atomic Energy Commission Reports (TID-4000) for reports when they are published.

Reports Not Published. The AEC depository libraries listed have been established as convenient points of reference for AEC-developed nonclassified information.

Translations. Copies of translations are available from SLA Translation Pool, John Crerar Library, 86 E. Randolph Street, Chicago 1, Illinois.

U. S. Patents. Copies of U. S. Patents are available from the U. S. Patent Office, Department of Commerce, Washington 25, D. C., for $0.25 per copy.

Non-AEC Reports. Reports prepared by organizations not under contract to the AEC, including foreign reports and reports designated by an NP number, should be requested from the issuing agency indicated in the descriptive cataloging of the report. These are not available from the AEC except to official requesters. Requests directed to the originators for NP reports should give the author and title, since NP numbers are applied to such reports by the AEC for its convenience only and may not be known to the issuing agency.

British and Canadian reports are available at AEC depository libraries. British reports can also be purchased from the British Information Service, 30 Rockefeller Plaza, New York, N. Y. Canadian reports (AECL series) can be purchased from the Scientific Document Distribution Office, Atomic Energy of Canada Limited, Chalk River, Ontario, Canada.

# TABLE OF CONTENTS

Vol. 11, No. 21, November 15, 1957


| Category | Abstract | Page |
|---|---|---|
| GENERAL | 11830 | 1317 |
| Atomic Bombs and Warfare | 11830 | |
| Atomic Power | 11832 | |
| Research Programs | 11838 | |
| BIOLOGY AND MEDICINE | 11840 | 1318 |
| Radiation Effects | 11840 | |
| Radiation Hazards and Protection | 11876 | |
| Radiotherapy | 11890 | |
| Tracer Applications | 11903 | |
| CHEMISTRY | 11911 | 1323 |
| Analytical Procedures | 11929 | |
| Deuterium and Deuterium Compounds | 11947 | |
| Fluorine and Fluorine Compounds | 11948 | |
| Graphite | 11950 | |
| Radiation Chemistry | 11952 | |
| Radiation Effects | 11956 | |
| Rare Earths and Rare-earth Compounds | 11966 | |
| Separation Procedures | 11967 | |
| Sorption Phenomena | 11989 | |
| Spectroscopy | 11992 | |
| Tracer Applications | 11993 | |
| Transuranic Elements and Compounds | 11997 | |
| Tritium and Tritium Compounds | 11998 | |
| Uranium and Uranium Compounds | 11999 | |
| Waste Disposal | 12005 | |
| ENGINEERING | 12008 | 1334 |
| Heat Transfer and Fluid Flow | 12011 | |
| Materials Testing | 12016 | |
| Pumps | 12021 | |
| Vacuum Systems | 12022 | |
| Waste Disposal | 12023 | |
| MINERALOGY, METALLURGY, AND CERAMICS | 12024 | 1337 |
| Ceramics and Refractories | 12024 | |
| Corrosion | 12026 | |

| Category | Abstract | Page |
|---|---|---|
| MINERALOGY, METALLURGY, AND CERAMICS | | |
| Geology and Mineralogy | 12036 | |
| Metals and Metallurgy | 12047 | |
| PHYSICS | 12068 | 1341 |
| Cosmic Radiation | 12088 | |
| Crystallography and Crystal Structure | 12093 | |
| Electrical Discharge | 12098 | |
| Electrons | 12103 | |
| Gases | 12105 | |
| Instruments | 12107 | |
| Isotopes | 12125 | |
| Isotope Separation | 12127 | |
| Mass Spectrography | 12129 | |
| Mathematics | 12133 | |
| Measuring Instruments and Techniques | 12139 | |
| Mesons | 12161 | |
| Microwaves | 12177 | |
| Neutrons | 12181 | |
| Nuclear Physics | 12186 | |
| Nuclear Properties | 12194 | |
| Nuclear Reactors | 12210 | |
| Nuclear Transformation | 12268 | |
| Particle Accelerators | 12279 | |
| Radiation Absorption and Scattering | 12284 | |
| Radiation Effects | 12288 | |
| Radioactivity | 12292 | |
| Rare Earths and Rare-earth Compounds | 12297 | |
| Shielding | 12300 | |
| Spectroscopy | 12301 | |
| Theoretical Physics | 12305 | |
| Uranium and Uranium Compounds | 12309 | |
| AUTHOR INDEX | | INDEX-1 |
| NUMERICAL INDEX OF REPORTS | | INDEX-6 |

NUCLEAR SCIENCE ABSTRACTS

Volume 11 November 15, 1957 No. 21

# GENERAL

## ATOMIC BOMBS AND WARFARE

**11830** WT-1181

Federal Civil Defense Administration, Washington, D. C. EXPOSURE OF MOBILE HOMES AND EMERGENCY VEHICLES TO NUCLEAR EXPLOSIONS. Ebe R. Shaw and Frank P. McNea. July 1957. 53p. Projects 36.1 and 36.2 [of] OPERATION TEAPOT. $1.50(OTS).

Experiments were conducted during Operation Teapot to determine the effects of a nuclear explosion on mobile homes at pressure levels which might be expected in the suburbs of a large city and to determine the effects on emergency vehicles and their equipment located at various simulated distances from near Ground Zero to the suburbs of a large city. Missiles produced by flying glass and the translocation of furniture in the mobile homes are potential hazards to personnel occupying these homes at the time of the blast. Screening or other means of protecting the interior against glass splinters reduces this hazard. By rearrangement of the displaced furniture, clearing up debris, and improvising window coverings, trailers in this area of damage could readily be made habitable. Emergency vehicles caught in the open near Ground Zero would be completely destroyed. Vehicles in medium- and low-pressure regions would suffer damage, but the vehicles and equipment would probably be operable. (auth)

**11831**

SEISMIC RECORDINGS OF ATOMIC EXPLOSIONS IN AUSTRALIA. H. A. Doyle (Australian National Univ., Canberra). Nature 180, 132-4(1957) July 20.

## ATOMIC POWER

**11832** AECU-tr-3005

PERSPECTIVES FOR THE UTILIZATION OF NUCLEAR FUEL FOR ELECTRIC POWER PURPOSES IN THE U.S.S.R. (Committee for Participation of U.S.S.R. in International Power Associations). Translated from Section V.3, Paper 7, presented at the World Power Conference, Belgrade, June 1957. 21p.

The USSR power reactor development program is reviewed. Prototype reactors to be built include a 300 Mw pressurized $H_2O$ reactor, a 180 Mw sodium graphite power reactor, a 200 Mw sodium graphite power breeder, and a 35 Mw $D_2O$–U salt homogeneous power breeder. (D.E.B.)

**11833**

INDIAN FIFTEEN YEAR PLAN FOR THE DEVELOPMENT OF ATOMIC ENERGY FOR PEACEFUL PURPOSES. Atombrief 3, No. 8, 13(1957) Aug. (In German)

**11834**

THE PROBLEM OF PRODUCING ATOMIC ENERGY FROM HYDROGEN. K. Kaindl. Atompraxis 3, 332(1957). (In German)

**11835**

BASIS AND ECONOMIC PERSPECTIVE OF ATOMIC ENERGY, ESPECIALLY FOR THE NETHERLANDS. J. M. W. Milatz. Reactor Centrum Nederland Bulletin 1, No. 3, 29-36, 38(1957) Aug. (In Dutch)

**11836**

THE FUTURE PRODUCTION OF ATOMIC ENERGY IN THE NETHERLANDS. Reactor Centrum Nederland Bulletin 1, No. 3, 39(1957) Aug. (In Dutch)

**11837**

THE INDUSTRIAL CHALLENGE OF NUCLEAR ENERGY. Paris, The Organization of European Economic Co-Operation, 1957. 291p. $5.00.

Papers are presented on fundamental problems of nuclear energy, reactor fundamentals and techniques, nuclear fuels and fuel cycles, the principal types of reactors, and reactor cost factors. The first nuclear power stations: Calder Hall, Marcoule, and Shippingport; the production, use, and industrial applications of radioisotopes; preparation and treatment of nuclear fuels; special reactor materials; mechanical and electronic equipment; and national and international nuclear energy programs are also discussed. (M.H.R.)

## RESEARCH PROGRAMS

**11838** BNL-439

Brookhaven National Lab., Upton, N. Y.

QUARTERLY PROGRESS REPORT [FOR] JANUARY 1–MARCH 31, 1957. 60p. $0.40(OTS).

Construction developments and proposed studies are discussed. Abstracts of work submitted for journal publication or presentation at scientific meetings are included in the fields of physics, chemistry, nuclear engineering, biology, and medicine. Studies for the Liquid Metal Fuel Reactor are discussed, with emphasis on metallurgy. The distributions of personnel exposures during 1956 are tabulated. The results are given of a series of test washing to determine the magnitude of problems of exposure and contamination control at the BNL decontamination laundry. (For preceding period see BNL-430.) (M.H.R.)

**11839** SC-4074(TR)

New Mexico. Univ., Albuquerque.

ERROR REDUCTION IN COMPUTATIONS. Roger J. Weldon. Nov. 15, 1956. 132p. For Sandia Corp. [Contract AT(29-1)-789]. $19.80(ph OTS); $6.30(mf OTS).

A condensation of this report and SC-3896(TR) was issued as AECU-3480.

Experiments were conducted on the problem of reducing computational errors through improved procedures. These experiments were controlled for subjects, type of computation, and amount of computation. A provisional unit of measure was developed as a control for amount of computation. Procedures studied included use of worksheets, checking procedures, and correcting procedures. Study of worksheets showed that different designs did not affect accuracy significantly, but did change computational speed significantly. A previous study had established partnership checking is not always feasible, emphasis in this study was upon self-checking procedures. Two types of code checking significantly increased checking efficiency over scan checking. The recheck correction procedure was also found useful in reducing errors. Where accuracy is critically important and a partner is not available, a combination of formal code checking and recheck correcting procedure was recommended. (auth)

# BIOLOGY AND MEDICINE

## RADIATION EFFECTS

**11840** AF-SAM-57-41
Utah. Univ., Salt Lake City Coll. of Medicine.
LOCALIZATION OF INTRAVENOUSLY INJECTED THORIUM DIOXIDE IN THE SPLEENS OF NORMAL AND X-IRRADIATED MICE. Ko Ko Gyi and Stanley Marcus. Sept. 5, 1956. 9p.

Total-body x-irradiation with 300, 400, or 500 r did not significantly affect uptake of thorotrast ($ThO_2$) by reticuloendothelial cells of the spleen when measured on the second postradiation day. Whole-body irradiation of 500 r, however, caused a significant depression in phagocytic activity of reticuloendothelial cells when localization of $ThO_2$ was measured on the seventh postradiation day. Chronic exposure of mice to x-radiation in doses of 25 r, three times per week delivered for a period of 6 to 11 weeks, had no effect on the phagocytic activity. It appears that the localization of intravenously injected $ThO_2$ in spleens of x-irradiated mice is a function of both the x-radiation dose and the postradiation period of observation. (auth)

**11841** NP-6398
Cnicago. Univ. Air Force Radiation Lab.
QUARTERLY PROGRESS REPORT NO. 24. July 15, 1957. 122p. Contract AF41(657)-25.

Progress is reported in the following studies: acute and chronic screening tests with 50 chemical compounds to determine their effect on the survival time, mortality, and weight loss of mice exposed to a lethal dose of whole-body x irradiation; the effects of $\beta$-aminoethylisothiuronium dichloride (AET) on blood glucose levels of rats and mice and demonstration of the ability of AET and other sulfur-containing compounds to counteract the hyperglycemia produced by thiourea derivatives; the effects of AET on oxidative enzymatic reactions involved in intermediary carbohydrate metabolism; and the mortality, weight changes, and incidence of cataract formation in mice exposed to fractionated low level doses of $\gamma$ or fast neutron irradiation. (For preceding period see NP-6334.) (C.H.)

**11842** NYO-2092
New York Operations Office. Health and Safety Lab. AEC.
GONADAL DOSE IN ROENTGEN EXAMINATIONS. A Literature Search. Henson Blatz and Wayne M. Lowder. Sept. 1956. 6p. $1.80(ph OTS); $1.80(mf OTS).

**11843** UCRL-3763
California. Univ., Berkeley. Radiation Lab.
EFFECTS OF CHRONIC EXPOSURE TO X-RAYS ON A STEADY-STATE POPULATION OF SACCHAROMYCES CEREVISIAE (thesis). Graeme Perry Welch. June 1957. 60p. Contract W-7405-eng-48. $0.40(OTS).

**11844** AEC-tr-3034
THE IMPORTANCE OF THE SINUS WALL FOR THE REGRESSIVE AND REGENERATIVE PROCESSES OF THE BONE MARROW. R. Stodtmeister, S. Sandkühler, and M. Fliedner. Translated by B. Smith from Schweiz. med. Woch. 85, 942-5(1955). 4p.

**11845**
PATHOLOGY OF RADIOISOTOPIC ABLATION OF THE THYROID IN THE DOG. Stuart W. Lippincott, Charles G. Lewallen, and Claire J. Shellabarger (Brookhaven National Lab., Upton, N. Y.). A.M.A. Arch. Pathol. 63, 540-56 (1957) June.

**11846**
THE MECHANISM RESPONSIBLE FOR SOME X-RAY INDUCED CHANGES IN FLOWER COLOR OF THE CARNATION, DIANTHUS CARYOPHYLLUS. Yoneo Sagawa and Gustav A. L. Mehlquist (Brookhaven National Lab., Upton, N. Y. and Univ. of Connecticut, Storrs). Am. J. Botany 44, 397-403(1957) May.

**11847**
BIPHASIC HYPERFERREMIA INDUCED IN RATS BY X-IRRADIATION. G. S. Melville, Jr., E. P. Conte, and A. C. Upton (Oak Ridge National Lab., Tenn.). Am. J. Physiol. 190, 17-18(1957) July.

**11848**
EFFECTS OF GAMMA RAYS ON SOLUTIONS OF HUMAN SERUM ALBUMIN. I. SEDIMENTATION STUDIES. D. Rosen and S. Brohult (Univ. of Uppsala, Sweden) and P. Alexander (Royal Cancer Hospital, London). Arch. Biochem. Biophys. 70, 266-76(1957).

**11849**
EFFECTS OF GAMMA RAYS ON SOLUTIONS OF HUMAN SERUM ALBUMIN. II. CHROMATOGRAPHIC STUDIES. Dennis Rosen and Hans G. Boman (Univ. of Uppsala, Sweden). Arch. Biochem. Biophys. 70, 277-82(1957).

**11850**
RADIATION INDUCED CANCER IN MAN. Stanford Cade. Brit. J. Radiol. 30, 393-402(1957) Aug.

**11851**
FIBROSARCOMA INVOLVING THE THYROID GLAND OF A SHEEP GIVEN $I^{131}$ DAILY. Sidney Marks, Lynn A. George, Jr., and Leo K. Bustad (General Electric Co., Richland, Wash.). Cancer 10, 587-91(1957) May–June.

**11852**
THE INFLUENCE OF HYBRIDIZATION ON RADIOSENSITIVITY. N. V. Luchnik. Doklady Akad. Nauk S.S.S.R. 114, 754-6(1957) June 1. (In Russian)

**11853**
EFFECTS ON COBALT $Co^{60}$ ON THE VITAMIN C CONTENT IN POTATOES. E. G. Sal'kova. Doklady Akad. Nauk S.S.S.R. 114, 757-9(1957). (In Russian)

**11854**
ON THE LOCAL AND DISTANT EFFECTS OF X RADIATION ON THE PROCESS OF CELL DIVISION. I. M. Shapiro. Doklady Akad. Nauk S.S.S.R. 114, 760-3(1957) June 1. (In Russian)

Mitotic changes in the mouse cornea epithelium were studied during local and distant exposures to x radiation. (R.V.J.)

**11855**
RADIATION-INDUCED PRESUMED SOMATIC MUTATIONS IN THE HOUSE MOUSE. Laine Brauch Russell and Mary H. Major (Oak Ridge National Lab., Tenn.). Genetics 42, 161-75(1957) Mar.

**11856**
EFFECT OF SUCCESSIVE X IRRADIATION ON NOCARDIA CORALLINA. J. B. Clark and R. B. Webb (Univ. of Oklahoma, Norman). J. Bacteriol. 74, 26-30(1957) July.

**11857**
MORTAL SYNDROMES AND DELAYED EFFECTS OF TOTAL AND SUBTOTAL IRRADIATIONS IN THE RAT. J. Maisin, P. Maldague, A. Dunjic, and H. Maisin. J. belge radiol. 40, 346-96(1957). (In French)

**11858**
ON THE DEPTH DOSE DETERMINATION. Mirjana Mihailović (Inst. of Physics, Ljubljana). "J. Stefan" Inst. Repts. (Ljubljana) 3, 233-5(1956) Oct.

To determine the constants for an approximate formula for depth dose evaluation, ionization measurements in a phantom of plexiglas were used. The influence of the area of the field on the depth dose was pointed out. (auth)

**11859**

DEPENDENCE ON OXYGEN AND TEMPERATURE OF THE SENSITIVITY OF BROAD BEAN ROOTS TO γ-RADIATION. G. J. Neary (Atomic Energy Research Establishment, Harwell). Nature 180, 248-9(1957) Aug. 3.

**11860**

RADIATION DANGER TO THE HEREDITARY FACTOR OF MAN. R. W. Kaplan. Naturwissenschaften 44, 433-8 (1957). (In German)

**11861**

FACTORS AFFECTING RADIATION-INDUCED DIVISION DELAY IN CHILOMONAS PARAMECIUM. Howard S. Duboff (Argonne National Lab., Lemont, Ill.). Physiol. Zoöl. 30, No. 3, 268-80(1957) July.

**11862**

SPECIAL PROBLEMS INHERENT IN THE STUDY OF HUMAN GENETICS WITH PARTICULAR REFERENCE TO THE EVALUATION OF RADIATION RISKS. James V. Neel (Univ. of Michigan Medical School, Ann Arbor). Proc. Natl. Acad. Sci. (U. S.) 43, 736 44(1957) Aug.

Problems inherent in the study of human genetics are reviewed. An attempt is made to evaluate the genetic risks of the increasing exposure of man to ionizing radiations. (C.H.)

**11863**

RADIATION PRESERVATION OF FOOD. H. F. Kraybill (Fitzsimons Army Hospital, Denver, Colo.). Public Health Repts. (U. S.) 72, 675-80(1957) Aug.

Treatment of foods with ionizing radiation promises revolutionary advances in food-preservation possibilities. There are still major technological problems in regard to acceptability of certain foods processed with a radiation dose of 2 or 3 million rep. However, treatment at lower radiation levels, which produces such results as inhibition of sprouting of potatoes, destruction of trichina in pork, increase in the keeping quality of food under refrigeration, and destruction of insect infestation, is generally successful. In experimental work undertaken thus far, radiation-sterilized foods have not been found toxic, nor has any evidence of carcinogenicity appeared. In animal feeding experiments with a wide variety of irradiated foods, reproduction and lactational performance in general are the same as for animals maintained on nonirradiated diets. One worker, using an irradiated synthetic diet, demonstrated slight impairment in lactational performance of mice, but this effect has not been induced in other animal species by feeding them irradiated foods. The nutritive value of these foods has been found to be equivalent to that for heat-processed foods. (auth)

**11864**

ENERGY DEPOSITION IN TISSUE AND SIMILAR MATERIALS BY 14.1-Mev NEUTRONS. M. L. Randolph (Oak Ridge National Lab., Tenn.). Radiation Research 7, 47-57 (1957) July.

A method is developed for the calculation of the ratio of dose rate to 14.1-Mev monoenergetic neutron flux produced by the $H^3(d, n)He^4$ nuclear reaction, taking into account known nonelastic reactions and the angular distributions for neutron scattering, for materials with specified composition of H, C, N, and O. The values of $d_1$, the energy dissipation per nucleus per unit flux, for these elements are found to be roughly constant. Typical results, probably accurate to within less than ±5%, for a number of hydrogenous materials are presented. Applications of these results include determination of dose rate from flux measurements, correction of dose values resulting from ionization measurements in nontissue-equivalent materials, and means of determining tissue equivalence. Further analysis discloses that higher average LET values obtain than if heavy nuclear products are ignored. For this and other neutron energies, more accurate and detailed knowledge of elastic and nonelastic reactions and the energy dissipation by heavy particles is needed. (auth)

**11865**

EFFECT OF TOTAL-BODY X-IRRADIATION ON SUSCEPTIBILITY OF MICE TO ESCHERICHIA COLI ENDOTOXIN. Jay P. Sanford and Howard E. Noyes (Walter Reed Army Medical Center, Washington). Radiation Research 7, 58-64 (1957) July.

The exposure of mice to 400 r total-body x irradiation uniformly resulted in leukopenia and weight loss. No increase in the susceptibility of x irradiated mice to an endotoxin prepared from a strain of Escherichia coli could be demonstrated, when compared to that of control mice, at intervals over a 21-day period of study. (auth)

**11866**

EFFECTS OF RAPID MASSIVE DOSES OF GAMMA-RAYS ON THE TESTES AND GERM CELLS OF THE RAT. J. F. Spalding, J. M. Wellnitz, and W. H. Schweitzer (Los Alamos Scientific Lab., N. Mex.). Radiation Research 7, 65-70 (1957) July.

**11867**

THE IRRADIATION OF DRY SPORES OF BACILLUS SUBTILIS WITH FAST CHARGED PARTICLES. J. Edward Donnellan, Jr., and Harold J. Morowitz (Yale Univ., New Haven, Conn.). Radiation Research 7, 71-8(1957) July.

Studies have been carried out on the effects of a wide energy range of protons, deuterons, and α-particles on B. subtilis spores. The dose survival curves are exponential, and the cross section versus LET curve is concave upward. There is no evidence of strong postirradiation treatment effects. (auth)

**11868**

THE EFFECT OF X-IRRADIATION ON THE PLASMA LIPID FRACTIONS OF THE RABBIT. N. R. Di Luzio and K. A. Simon (Oak Ridge National Lab., Tenn. and Univ. of Tennessee Medical Units, Memphis, Tenn.). Radiation Research 7, 79-84(1957) July.

**11869**

ACUTE LETHALITY STUDIES WITH THE RAT: THE $LD_{50}$, DEATH RATE, AND RECOVERY RATE. Henry I. Kohn and Robert F. Kallman (Univ. of California School of Medicine, San Francisco). Radiation Research 7, 85-97(1957) July.

**11870**

PARADOXICAL RESISTANCE OF THYMUS LYMPHOCYTES TO HIGH DOSES OF X-RADIATION. O. A. Trowell, M. J. Corp, and W. R. Lush (Medical Research Council, Harwell, Berkshire, Eng.). Radiation Research 7, 120-8(1957) Aug.

Radiosensitivities of the lymphocytes in various lymphoid organs of the young rat were compared by determining the percentages of pyknotic lymphocytes present 5 hours after whole-body exposure to various doses of high-intensity x radiation. The lymphocytes of the spleen, the thymus (up to 5000 r), and the six different lymph nodes studied were equally sensitive to radiation. The lymphocytes of Peyer's patches were distinctly more sensitive than these. The response of the thymus lymphocytes was paradoxical in that after very high doses fewer lymphocytes became pyknotic than after lower doses. All the thymus lymphocytes were

pyknotic 11 hours after 2010 r, but a considerable proportion were still not pyknotic 23 hours after 13,400 r. Head shielding did not alter the response. Experiments showed that the failure of some of the thymus lymphocytes to undergo pyknotic degeneration after high doses of radiation was not due to their fixation (in the histological sense), nor was it due to the inactivation of autolytic enzymes. No explanation has been found for the phenomenon itself or for the fact that the thymus is the only lymphoid organ to exhibit it. (auth)

**11871**

THE EFFECTS OF WHOLE-BODY X-IRRADIATION ON PERITONEAL FLUID CELLS AND PERIPHERAL BLOOD LEUKOCYTES IN POLLEN-SENSITIZED RATS. F. G. Buch, H. A. Charipper, and A. Edelmann (New York Univ., New York and Brookhaven National Lab., Upton, N. Y.). Radiation Research 7, 129-38(1957) Aug.

The concurrent effects of x irradiation (750 r) on the number of cells per cubic millimeter in peritoneal fluid and in blood have been observed at 2 and 6 days after single whole-body exposure of nonsensitized and pollen-sensitized rats. Pollen sensitization increases the number of peritoneal fluid cells but not the number of peripheral white blood cells. The decreases in total peritoneal fluid cell population after x irradiation are always less than the reductions in numbers of white blood cells. In the nonsensitized rat decreases in total cells, eosinophils, mast cells, and mononuclear cells in the peritoneal fluid occur at 2 and 6 days after x irradiation. In the pollen-sensitized rats eosinophils are less in number at 2 days after x irradiation, but significant decreases in total cells and mononuclear cells are not apparent until 6 days after. The number of mast cells is not affected in the x-irradiated, pollen-sensitized rat. There are more peritoneal fluid eosinophils, mononuclear cells, and mast cells in the x-irradiated, pollen-sensitized rat than there are in the x-irradiated nonsensitized rat. Preliminary observations indicate a higher survival rate in pollen-sensitized x-irradiated rats than in nonsensitized x-irradiated rats, which may be open to question when subjected to statistical analysis. It is postulated that survival has a direct relation to the specific composition of the peritoneal fluid cell population and the physiology of its cellular components. (auth)

**11872**

THE EFFECTS OF TOTAL-BODY X-IRRADIATION ON BLOOD VOLUME IN SPLENECTOMIZED DOGS. L. Lukin (Columbia Univ. Coll. for Physicians and Surgeons, New York). Radiation Research 7, 150-60(1957) Aug.

Splenectomized dogs were exposed to 1000-r total-body irradiation. This dose gave a consistent survival period of only 3½ to 4 days. The brief survival period minimizes secondary complications such as starvation and infection. Plasma volumes were measured with T-1824, red cell volumes with $P^{32}$. A control measurement was done prior to irradiation, and the determinations repeated on the second and third postirradiation days. On the average the blood volume was reduced by only 1% on the second day and 8.8% on the third day. Control experiments on non-irradiated dogs showed that one-third to one-half of the loss on the third day was caused by withdrawal of blood samples. Statistical evaluation shows that, although the changes in total blood volume in the irradiated and nonirradiated groups do not differ significantly, the changes in red cell volume on the third day have borderline significance. It is concluded from the results that the blood volume is well maintained up to the last day before death. (auth)

**11873**

PREMORTAL BLOOD VOLUMES IN SPLENECTOMIZED DOGS AFTER TOTAL-BODY X-IRRADIATION. L. Lukin and M. I. Gregersen (Columbia Univ. Coll. for Physicians and Surgeons, New York). Radiation Research 7, 161-6 (1957) Aug.

As an extension of a previous study, splenectomized dogs exposed to a single dose of 1000 r total-body x radiation were subjected to blood volume measurements during the last 10 hours of survival. The results indicate a drastic reduction of 25 to 35% in the total blood volume in the premortal stage. Plasma volume, measured with T-1824, decreased by 35 to 48%, whereas red cell volume, measured with $Cr^{51}$, decreased by 13 to 20%. It is concluded that death is associated with the development of stagnant anoxia and that the loss of fluid from the plasma occurs chiefly through the gastrointestinal tract. (auth)

**11874**

POSTIRRADIATION CREATINURIA IN THE RAT. C. M. Williams, G. M. Krise, D. R. Anderson, and R. M. Dowben (Univ. of Texas; U. S. Air Force, Austin, Texas; and Randolph AFB, Texas). Radiation Research 7, 176-83(1957) Aug.

A creatinuria of about 20-fold the preirradiation level was found in rats during the first 5 days after irradiation with 1500 rep of $Co^{60}$ $\gamma$ rays. A concomitant 3-fold increase in the plasma creatine was also found. Irradiation with 750 rep of $\gamma$ rays resulted in a creatinuria which was not so pronounced. Irradiation with 1500 rep of x rays resulted in a 20- to 30-fold creatinuria on the second postirradiation day. Exposure to 435 rep of neutrons and $\gamma$ rays (neutron to $\gamma$ ray ratio on a rep basis of 3:1) resulted in a 36- to 63-fold creatinuria on the second postirradiation day. In animals that died, a profound creatinuria, reaching levels as high as eighty-five times the preirradiation value, was found, which continued until death. (auth)

**11875**

EARLY MATURING X-RAY MUTATIONS OF JUTE (CORCHORUS OLITORIUS LINN). K. L. Chaudhuri. Trans. Bose Research Inst. Calcutta 19, 89-105(1953-55).

Seeds of Corchorus olitorius R 26 were exposed in the dry state to 20 mAh = 8,000 r units, 28 mAh = 11,200 r units and 36 mAh = 14,000 r units. Five plants in the treated populations, two from the 20 mAh and three from the 28 mAh, flowered much earlier than the control. All these plants flowered during the eighth week (52 to 55 days) as against the first flowering control plant that took more than 15 weeks (110 days). In the $X_2$ populations raised from the early selections mean earliness varied between 14 and 21 days in the first replication. In the second replication the mean earliness varied between 18 and 35 days. In the $X_3$, sown on 30-4-49, the mean earliness in the five populations was found to vary between 6 and 20 days. In order to determine the significance of earliness of the various populations the data were examined statistically. The early responses of $X_2$ and $X_3$ populations over the controls were found to be clearly significant with probability less than 0.001 in every case. It appears from the above that the changes brought about in the mechanism of flower formation is inherited in the subsequent generations and such inheritance could be only due to the action of x rays on the organization of the genes in some of the chromosomes, which are responsible for the duration of the vegetative periods and the initiation of flowering in the plants. The early strains are suitable to the low lands which during the late rainy season become inundated. An effective double cropping by rotating aman paddy with these strains of Jute may conveniently be introduced. (auth)

## RADIATION HAZARDS AND PROTECTION

**11876** AF-SAM-57-42

Rochester, N. Y. Univ., School of Medicine and School of Aviation Medicine, Randolph AFB, Texas.

FAILURE OF BETA-AMINOETHYLISOTHIOURONIUM DIBROMIDE TO PROTECT AGAINST LETHAL TOTAL-BODY X-IRRADIATION IN DOGS. Richard E. Benson, Sol Michaelson, and Joe W. Howland. Sept. 7, 1956. 6p.

A new compound, β-aminoethylisothiouronium dibromide (AET), has been employed as a protective agent against the lethal effects of x radiation in dogs. Clinical and hematologic observations are reported. Data are presented which indicate failure of this compound to enhance survival. (auth)

**11877** HW-47500

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

BIOLOGY RESEARCH ANNUAL REPORT [FOR] 1956. Jan. 4, 1957. 237p. Contract W-31-109-Eng-52. $1.25 (OTS).

Late in 1956 a reorganization at Hanford disbanded the Radiological Sciences Department and transferred the Biology Section, with its name changed to Biology Operation, to the Hanford Laboratories Operation. Emphasis of the research program changed from being primarily Hanford oriented toward being more concerned with radiobiological problems derived from the general needs of radiation hazard control. Data are presented from the following studies: the effect of age on the absorption and skeletal deposition of $P^{32}$; the effect of dietary Ca on the skeletal deposition of $Sr^{90}$; the pathological effects of ingested $Ru^{106}$ and $Cs^{137}$ in rats, and the determination of permissible limits for $Ru^{106}$ in drinking water; the toxic effects of continued dietary $I^{131}$ in sheep; the development of a special metabolism cage for swine receiving radioisotopes; determination of the effects of a triple radiation assault in lambs; the effects of β particles on pig skin; the cutaneous absorption of Pu from a $PuF_4$ solution; the decontamination of animal skin contaminated with Pu by applying a plastic coating to the contaminated area and then pulling it off; the pathological effects of radioactive particles in the lungs of mice; the effect of CaEDTA on the radiosensitivity of yeast; and the uptake of $Sr^{90}$ by plants from contaminated soil. A list of talks presented at scientific meetings and publications during the period is included. (For preceding period see HW-41500.) (C.H.)

**11878**

LEUKEMOID BLOOD AND LEUKOCYTES IN TREATMENT OF RADIATION LETHALITY. L. H. Smith and C. C. Congdon (Oak Ridge National Lab., Tenn.). A.M.A. Arch. Pathol. 63, 502-7(1957) May.

**11879**

THE HOMOTRANSPLANTATION OF FUNCTIONAL ERYTHROPOIETIC ELEMENTS IN THE RAT FOLLOWING TOTAL-BODY IRRADIATION. T. T. Odell, Jr., Frances G. Tausche, and D. L. Lindsley (Oak Ridge National Lab., Tenn.) and R. D. Owen (California Inst. of Tech., Pasadena). Ann. N. Y. Acad. Sci. 64, 811-23(1957) Mar. 22.

**11880**

THE EFFECT OF THE AMOUNT OF ISOLOGOUS BONE MARROW INJECTED ON THE RECOVERY OF HEMATOPOIETIC ORGANS, SURVIVAL AND BODY WEIGHT AFTER LETHAL IRRADIATION INJURY IN MICE. Paul Urso and C. C. Congdon (Oak Ridge National Lab., Tenn.). Blood 12, 251-60(1957) Mar.

**11881**

RETENTION AND EXCRETION OF RADIOSTRONTIUM IN MONKEYS. A. H. Ward (Univ. Coll. of the Gold Coast). J. Nuclear Energy 5, 192-202(1957).

Single injections of $Sr^{90}$ from 3 μc/kg to 2 mc/kg body weight have been made in a colony of eighty monkeys kept under natural conditions in the tropics. Radioactivity measurements of excretion and retention over a 3-year period are presented, and the relatively slow rate of excretion is analyzed for twenty-eight monkeys. The variation of percentage excretion and retention with injection-dose is shown, and a comparison made with excretion of radiostrontium by other animals and of radium by man. (auth)

**11882**

INFLUENCE OF POST-IRRADIATION ADMINISTRATION OF METHIONINE AND THE LEVELS OF DEOXYRIBONUCLEIC ACID IN BONE MARROW, SPLEEN AND LIVER OF RATS. M. K. Nerurakar, A. J. Baxi, N. S. Ranadive, M. V. Narurkar, and M. B. Sahasrabudhe (Atomic Energy Establishment, Indian Cancer Centre, Parel, Bombay). Nature 180, 193-4(1957) July 27.

**11883**

PRODUCTION OF RAT SERUM PROTEINS IN IRRADIATED MICE. W. W. H. Weyzen and O. Vos (National Defence Research Council TNO, Rijswijk (Z.H.), Netherlands). Nature 180, 288-9(1957) Aug. 10.

**11884**

RADIOACTIVE FALLOUT. Willard F. Libby. Proc. Natl. Acad. Sci. (U. S.) 43, 758-75(1957) Aug.

The radioactivity produced by the fission reaction changes its characteristics continuously and rapidly following the explosion of an atomic weapon, and the conditions of firing are of extreme importance in determining the rate at which the radioactivity descends to earth. Hazard from local fall-out, tropospheric fall-out, and stratospheric fall-out are evaluated. Hazards to man from the uptake of environmental radiocesium and radiostrontium are considered in detail. Data are presented from surveys on variations in individual $Sr^{90}$ burdens, variations of the $Sr^{90}$ body burden with locality, and the estimated effects of continued nuclear weapons testing on the body burden of $Sr^{90}$. Project Sunshine, established to study the problems of world-wide fall-out, is discussed briefly. (C.H.)

**11885**

CHEMICAL PROTECTION AGAINST IONIZING RADIATION. I. SAMPLING METHODS FOR SCREENING COMPOUNDS IN RADIATION PROTECTION STUDIES WITH MICE. A. W. Kimball, W. T. Burnett, Jr., and David G. Doherty (Oak Ridge National Lab., Tenn.). Radiation Research 7, 1-12 (1957) July.

**11886**

CHEMICAL PROTECTION AGAINST IONIZING RADIATION. II. MERCAPTOALKYLAMINES AND RELATED COMPOUNDS WITH PROTECTIVE ACTIVITY. David G. Doherty, W. T. Burnett, Jr., and Raymond Shapira (Oak Ridge National Lab., Tenn.). Radiation Research 7, 13-21(1957) July.

Thirty amino and substituted aminosulfhydryl compounds have been tested in mice for protective activity against a lethal dose of x radiation. The most effective compounds in providing survival against a single 800-r dose of x rays were 2-mercaptoethylamine, its disulfide, and 3-mercaptopropylamine. The hypothesis is advanced that these compounds are protective by virtue of their direct reaction with radiation-induced radicals to form resonance-stabilized hybrids that react preferentially with other radicals and not with sensitive biological material. The structure essential for activity in this class of compounds appears to consist of an amino group sepa-

rated by not more than three carbon atoms from a sulfhydryl or disulfide group. (auth)

**11887**

CHEMICAL PROTECTION AGAINST IONIZING RADIATION. III. MERCAPTOALKYLGUANIDINES AND RELATED ISOTHIURONIUM COMPOUNDS WITH PROTECTIVE ACTIVITY. Raymond Shapira, David G. Doherty, and W. T. Burnett, Jr. (Oak Ridge National Lab., Tenn.). Radiation Research 7, 22-34(1957) July.

A series of sixteen isothiuronium compounds, twenty-seven amino or substituted aminoalkylisothiuronium salts, thirteen thiazolines, and eighteen mercaptroalkylguanidines have been tested for toxicity and screened for protective activity against a lethal dose of x radiation to mice. A hypothesis has been made that, on a molar basis, those mercaptoalkylguanidines capable of forming five- or six-membered cyclic intermediates will be the most active protective agents. 2-Mercaptoethylguanidine (MEG) and 3-mercaptopropylguanidine (MPG) were found to be more active than 2-mercaptoethylamine (MEA) and less toxic than MEA, with a therapeutic ratio about 2 to 1. These two compounds, MEG and MPG, could be readily prepared in a pure state from the corresponding aminoalkylisothiuronium salts. (auth)

**11888**

STRONTIUM-CALCIUM MOVEMENT FROM SOIL TO MAN. C. L. Comar and R. H. Wasserman (Oak Ridge Inst. of Nuclear Studies, Tenn.) and R. Scott Russell (Univ. of Oxford, England). Science 126, 485-92(1957) Sept.

Radiostrontium moves similarly to calcium in food chains, is well absorbed by plants, animals, and man; is deposited and retained in bones; is transmitted to milk and to the developing fetus; and is known to cause bone tumors and is suspected of causing leukemia. Megaton nuclear explosions result in a large fraction of the $Sr^{90}$ formed being deposited in the stratosphere. This material slowly passes back into the troposphere with an average residence in the stratosphere of about 10 years. Kiloton weapons deposit their $Sr^{90}$ in the troposphere. Radioactivity in the troposphere, regardless of origin, is relatively quickly deposited on the surface of the earth, primarily by precipitation. The comparative movement of Sr and Ca in biological systems is discussed. Findings related to the differential behavior of the two elements are reviewed. The data are intended to serve as a basis for predicting the levels of $Sr^{90}$ to be expected when the soil content and dietary intake can be estimated. (C.H.)

**11889**

RULES FOR PROTECTION AGAINST IONIZING RADIATION. F. Fossati, P. Gallone, L. Parmeggiani, C. Polvani, and M. Scolari. Milan, Ulrico Hoepli, 1956. 289p. (In Italian)

## RADIOTHERAPY

**11890**

OXYGENATION IN RADIOTHERAPY. I. RADIOBIOLOGICAL CONSIDERATIONS. L. H. Gray (Mount Vernon Hospital, Northwood, Middlesex). Brit. J. Radiol. 30, 403-6 (1957) Aug.

**11891**

OXYGENATION IN RADIOTHERAPY. II. CLINICAL APPLICATION. I. Churchill-Davidson and C. Sanger (St. Thomas's Hospital, London) and R. H. Thomlinson (Hammersmith Hospital, London). Brit. J. Radiol. 30, 406-22 (1957) Aug.

**11892**

VALUE OF RADIOCHEMICAL THERAPY IN LYMPHOBLASTOMATA. Mauro Piemonte. Giorn. ital. chemioterap. 3, 478-88(1956). (In Italian)

**11893**

PRELIMINARY REPORT ON THE TREATMENT WITH THORIUM X ISOTOPE. F. Debevec (Orthopaedic Clinic Med. Fac., Ljubljana). "J. Stefan" Inst. Repts. (Ljubljana) 3, 237-9(1956) Oct.

Observations on 36 patients under treatment with Th X for ankylosing spondylitis and severe chronic rheumatoid arthritis are summarized. (M.H.R.)

**11894**

DOSE MEASUREMENTS ON THE 31 Mev BETATRON. Nadja Fajdiga (Univ., Ljubljana). "J. Stefan" Inst. Repts. (Ljubljana) 3, 241-6(1956) Oct.

Dose distribution measurements were made on the 31 Mev betatron for use in therapy. Fields for all kinds of treatment cones have been determined by means of the Victoreen chambers, and the integral rate-meter, made at the institute, has been calibrated. At the same time the linearity of the Victoreen chambers at major doses was controlled. (auth)

**11895**

RADIOTHERAPY OF MALIGNANT TUMOURS BY THE 31 Mev BETATRON. Bozena Ravnihar (Univ., Ljubljana). "J. Stefan" Inst. Repts. (Ljubljana) 3, 247-54(1956) Oct.

The technique of irradiation with the 31 Mev betatron is described in 34 cases of malignant tumors treated in Institute "Jožef Stefan." The depth dose distribution and the relation of the dose in healthy tissue to the dose in the tumor region are presented, being a particularity and an advantage of the irradiation of deeply seated tumors with these ultrhard rays, compared with ordinary x ray irradiation. The observed effects of betatron irradiation in some individual cases are mentioned and the indications for this therapy are outlined. (auth)

**11896**

SOME RESULTS OF USE OF RADIOISOTOPES IN THE MEDICAL CLINIC IN LJUBLJANA. Bojan Varl (Medizinische Klinik Ljubljana). "J. Stefan" Inst. Repts. (Ljubljana) 3, 255-60(1956) Oct. (In German)

**11897**

AUGMENTATION OF RADIOTHERAPEUTIC EFFECT BY CANCER CHEMOTHERAPY. Morton M. Kligerman and Daniel M. Shapiro (Columbia Univ. and Presbyterian Hospital, New York). Radiology 69, 194-200(1957) Aug.

**11898**

PORPHYRINS AS MODIFIERS OF THE EFFECTS OF ROENTGEN RAYS. Merle K. Loken (Univ. of Minnesota Hospitals, Minneapolis). Radiology 69, 201-3(1957) Aug.

**11899**

COMBINED THERAPY: RADIATION AND CHEMICALS. Sydney F. Thomas (Palo Alto Medical Clinic., Calif.). Radiology 69, 204-8(1957) Aug.

**11900**

FIRST IMPRESSIONS OF THERAPY WITH CESIUM 137. Francisco Comas and Marshall Brucer (Oak Ridge Inst. of Nuclear Studies, Tenn.). Radiology 69, 231-5(1957) Aug.

**11901**

CLINICAL USE OF RADIOISOTOPES. Theodore Fields and Lindon Seed, eds. Chicago, The Year Book Publishers, 1957. 455p.

Techniques are described which are preferred by experienced users for clinical diagnostic and therapeutic

applications of radioisotopes. In addition, the medical rationale, health physics precautions, and government regulations governing the use of radioactive materials are discussed. 313 references. (C.H.)

**11902**

GRAPHS AND TABLES FOR RADIOTHERAPY. Felix Wachsmann and Alexander Dimotsis. Stuttgart, S. Hirzel Verlag, 1957. 184p. (In English, French, Spanish, and German)

### TRACER APPLICATIONS

**11903** NP-6353

Food and Agriculture Organization of the United Nations, Rome. European Commission on Agriculture.

REPORT OF THE FIRST MEETING OF THE EUROPEAN CONTACT GROUP ON THE USES OF ISOTOPES AND RADIATION IN AGRICULTURAL RESEARCH HELD IN WAGENINGEN, NETHERLANDS ON DECEMBER 10-14, 1956. Meeting Report No. 1956/27. 41p.

Topics discussed include programs in European countries covering uses of isotopes in soil science, plant science, animal science, plant breeding, uses of radiation in food preservation and processing, training facilities and programs in progress, the design and equipment of laboratories for agricultural research, waste disposal problems, and the development of new experimental techniques. (C.H.)

**11904**

THE EXCRETION OF THORIUM AND THORIUM DAUGHTERS AFTER THOROTRAST ADMINISTRATION. J. B. Hursh, L. T. Steadman, W. B. Looney, and M. Colodzin (Univ. of Rochester, N. Y. and U. S. Naval Hospital, Bethesda, Md.). Acta Radiol. 47, 481-98(1957) June.

**11905**

RADIOACTIVE ISOTOPES IN MEDICINE. Donald J. Rosenthal and John H. Lawrence (Univ. of California, Berkeley). Ann. Rev. Med. 8, 361-88(1957).

A review is presented on medical applications of radioactive isotopes in research, diagnosis, and therapy. 217 references. (C.H.)

**11906**

THE USE OF RADIOISOTOPES IN TRACING SEWAGE INTRODUCED INTO THE SEA AND COASTAL WATERS. E. Sons. Atompraxis 3, 306-9(1957). (In German)

**11907**

THE EFFECT OF X RAYS UPON THE UPTAKE OF PHOSPHORUS 32 BY THE KNEE JOINT OF SIX-WEEK-OLD MICE. MODIFICATION OF THE EFFECT BY PRE-IRRADIATION INTRAPERITONEAL INJECTION OF CYSTEAMINE. C. W. Wilson (Westminster Hospital, London). Brit. J. Radiol. 30, 443-4(1957) Aug.

**11908**

THE APPLICATION OF RADIOACTIVE SODIUM FOR THE DETERMINATION OF THE CIRCULATION RATE IN THE LOWER EXTREMITIES. Z. M. Beekman. J. belge radiol. 40, 313-20(1957).

**11909**

STRONTIUM-90 AND SKELETAL FORMATION. Wright H. Langham and Ernest C. Anderson (Los Alamos Scientific Lab., N. Mex.). Science 126, 205-6(1957) Aug. 2.

The potential radiostrontium level to be expected in the skeletons of growing children as a result of environmental contamination was computed. Results are based on available data on the rate of bone remodeling and exchange, the rate of skeletal growth, and the level of $Sr^{90}$ in the biosphere. (C.H.)

**11910**

ISOTOPIC TRACERS IN BIOLOGY. AN INTRODUCTION TO TRACER METHODOLOGY. Martin D. Kamen. New York, Academic Press Inc., 1957. 485p.

Applications of stable and radioactive isotopes in biological research are reviewed. Related chemical, physical, and biochemical applications and methodology are discussed. Numerous concrete examples illustrating work with tracers are included. 124 references. (C.H.)

## CHEMISTRY

**11911** AECU-3545

Michigan. Univ., Ann Arbor.

ALTERNATING CURRENT POLAROGRAPHY: DETERMINATION OF THE TRANSFER COEFFICIENT OF ELECTROCHEMICAL PROCESSES. Report No. 27. Henry H. Bauer and Philip J. Elving. July 15, 1957. 24p. Project 8. Contract AT(11-1)-70. $4.80(ph OTS); $2.70 (mf OTS).

The apparatus and technique previously described for use in sinusoidal wave alternating current polarography have been simply modified to permit the determination of the transfer coefficients for electrochemical reactions. The procedure developed is a modification of that proposed by van Cakenberghe, which is based on measurements of the even harmonics of the alternating current. The improved procedure is simple and rapid, and permits determination of the transfer coefficient to a precision of about $\pm 0.01$ or $\pm 0.02$. The apparatus, operation and critical features are described in some detail. The proposed procedure was used to measure the transfer coefficients for the reduction of Cd(II) at the D.M.E. in various media. A significant difference was observed between the values in KCl and $NaSO_4$ solutions; the value in HCl solution is midway between the other two. No significant changes in the transfer coefficient were apparent on varying the concentrations of Cd(II) or of background electrolyte, the temperature, or the amplitude and frequency of the superposed alternating potential. (auth)

**11912** AECU-3548

Hooker Electrochemical Co., Niagara Falls, N. Y.

BORON AND ITS ISOTOPES. June 1957. 11p. Contract [AT(30-1)-1524]. $1.80(ph OTS); $1.80(mf OTS).

Data are briefly presented on the physical, chemical, and nuclear properties of B, separation of the isotopes, uses of $B^{10}$ and $B^{11}$, chemical properties of dimethyl ether–boron trifluoride complex and potassium fluoborate, and toxicity and hazards. A graph of nuclear cross sections in the low-energy range is included. (J.E.D.)

**11913** AECU-3554

Bureau of Mines. Div. of Explosives Technology, Pittsburgh.

ZIRCONIUM HAZARDS RESEARCH. Progress Report No. 1 [for] September 1, 1956 to February 28, 1957. J. A. Herickes and P. A. Richardson. Feb. 28, 1957. 44p. Contract AT(11-1)-473. $7.80(ph OTS); $3.30(mf OTS).

Properties of the various forms and alloys of Zr which affect inflammability and explosiveness, and the reaction mechanisms involved in the sensitization of Zr were studied. Emphasis was placed on the assessment of hazards involved in the manufacture, handling, storage, and shipping of Zr. Titanium and hafnium were examined on a very limited scale in order to establish the relative sensitivity of the three metals. (auth)

**11914** BMI-1210

Battelle Memorial Inst., Columbus, Ohio.

THE ZIRCONIUM–URANIUM DIOXIDE REACTION. Manley W. Mallett, John W. Droege, Arnold F. Gerds, and Alexis W. Lemmon, Jr. July 22, 1957. 69p. Contract W-7405-eng-92. $2.00(OTS).

The solid-solid reaction between Zr and $UO_2$ was studied in the temperature range of 750 to 2000°F by means of welded sandwich-type elements. The extent of reaction was evaluated on the basis of metallographic examinations of sample cross sections. The phases formed were identified by x-ray-diffraction techniques. In the temperature range of 750 to 1200°F, months of heating were required to produce measurable reaction zones. Easily measured reaction zones were produced in about 1 month at 1300°F and in a few hr at 1600 and 2000°F. A limited number of experiments indicated that Zircaloy-2 reacted less rapidly than Zr with $UO_2$. The reaction of Zr with $UO_2$ resulted in the dissolution of $UO_2$ in Zr as U and $O_2$. These diffused into the Zr at unequal speeds. Zirconium diffused in the opposite direction to further the reaction. Inert W markers were used to mark the position of the initial interfaces. Reaction and diffusion rates were determined from analyses of thin layers machined from the Zr. (auth)

**11915** HW-34811

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

INVESTIGATION OF ULTRASONIC DECONTAMINATION. Interim Report. [R. F. Cortlett and J. W. Kolb]. Jan. 28, 1955. 12p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

A preliminary study and evaluation of the application of ultrasonic equipment and associated handling equipment to the problem of decontaminating reactor tube dummy pieces were made. It was felt that use of ultrasonics together with a solution less corrosive than $HNO_3$ might provide adequate decontamination at lower project cost than the presently proposed $HNO_3$ facilities. The progress of the investigation to date is given. (auth)

**11916** HW-46366

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

TRIP REPORT—CONSULTATION ON ORGANIC REACTOR COOLANTS. J. M. Atwood, M. W. Cook, and P. P. Eddy. Nov. 5, 1956. 16p. Contract [W-31-109-Eng-52]. $3.30 (ph OTS); $2.40(mf OTS).

The work at various installations on organic reactor coolants is given. The radiolytic decomposition rate of monoisopropylbiphenyl is not measurably increased in increasing temperature from 450 to 600°F. (W.L.H.)

**11917** MLM-534

Mound Lab., Miamisburg, Ohio.

STATUS OF POLONIUM DISTILLATION UNIT. (Information Report). R. W. Endebrock. Jan. 25, 1951. Decl. July 18, 1957. 6p. Contract At-33-1-GEN-53. $1.80(ph OTS); $1.80(mf OTS).

A study was made of materials for handling Bi at elevated temperatures and reduced pressures. The main problems and considerations in the choice of materials of construction of the Po–Bi distillation unit are presented. (auth)

**11918** NP-6399

Lehigh Univ., Bethlehem, Penna. Surface Chemistry Lab.

HETEROGENEITY OF SURFACES; CALORIMETRIC AND ADSORPTION STUDIES OF THE OXIDATION OF Ni, Co, AND Cu IN THE THIN FILM REGION. Adsorption Studies on Attapulgite Clay. Technical Report No. 1 [for] January 1, 1956 to May 31, 1957. 66p. Project NRO-51-186. Contract NONR-1820(00).

The rates of oxidation of reduced Ni, Co, and Cu powders were measured in the thin film region in the temperature range from −78 to 26°. During the first oxidation at each temperature multiple layers of oxide formed instantaneously. In each case, a slow process followed. The oxide covered surfaces of Ni and Co, and to a lesser extent Cu, could be regenerated for further fast oxidation by heating in vacuum. Oxygen uptake was measured on these activated surfaces. Heats of chemisorption of O on the reduced and regenerated surfaces were determined with a precision calorimeter. From these studies mechanisms for the oxidation and regeneration processes are proposed. (auth)

**11919** NRL-4938

Naval Research Lab., Washington, D. C.

THE IRRADIATION OF POLYVINYL METHYL ETHER WITH ELECTRONS AND GAMMA RAYS TO FORM ELASTOMERS. Dick Duffey. Apr. 12, 1957. 35p. Projects NR 523-000 and NR 523-001.

Polyvinyl methyl ether and mixtures of this ether with a variety of powdered fillers were irradiated with electrons from a Van de Graaff and gamma rays from $Co^{60}$. The fillers included carbon black, magnesia, silica, iron oxide, calcium phosphate, calcium carbonate, clay, zinc oxide, rutile, chromium sesquioxide, litharge, antimony trisulfide, zinc sulfide, barytes, zircon, calcium fluoride, antimony trioxide, zinc borate. The ether crosslinked; however, fillers were necessary to give products with much strength. Carbon black, magnesia, silica, iron oxide, and calcium phosphate resulted in significant reinforcement. Ordinary chemical methods of crosslinking, or vulcanization, were ineffective. The optimum amount of fillers for strength was about 30% of the mixture by volume, and the required radiation levels were the order of 40 megaroentgens. Tensile strengths of over 1500 psi with elongations at breaking of 100 to 200% were obtained. The products swelled in the solvents of the crude ether. In particular, cold water swelled the products, which could be a serious limitation to many uses. Some liquids, such as straight chain hydrocarbon and caustic solution, did not effect the product appreciably. (auth)

**11920** UCRL-3872

California. Univ., Berkeley. Radiation Lab.

FORMATION OF > C = O BONDS IN THE RADIATION-INDUCED OXIDATION OF PROTEIN IN AQUEOUS SYSTEMS. Michael E. Jayko and Warren M. Garrison. July 17, 1957. 5p. Contract W-7405-eng-48. $1.80(ph OTS); $1.80(mf OTS).

Studies of the reactions of irradiated pepsin solutions with 2,4-dinitrophenylhydrazine are described. The data indicate that formation of the > C = O bond is a principal chemical effect of the attack of hydroxyl radicals on pepsin in oxygenated solution. Dialysis and precipitation studies show (a) that the carbonyl products are of high molecular weight and (b) that more than one oxidation path is involved. Parallel studies of the action of Fenton's reagent on aqueous gelatin indicate that similar oxidation processes occur. Preliminary investigations of irradiated tissue homogenates suggest that carbonyl formation may represent a major process in the radiation chemistry of biological systems. It is pointed out that oxidation of substances other than protein may be involved. (auth)

**11921** AEC-tr-2938

ON THE CONSTITUTION OF ALUMINUM HALIDE AMMONIATES. [PART] I. Wilhelm Klemm and Erich Tanke. [PART] II. MONOAMINES AS "ADDITION PRODUCTS."

Wilhelm Klemm, Elsbeth Clausen, and Helmut Jacobi. (Contributions to the Systematic Law of Affinity). Translated from Z. anorg. allgem. Chem. 200, 343-84(1931). 62p.

**11922** AEC-tr-2957
ON THE KINETICS OF VERY RAPID ION REACTIONS IN AN AQUEOUS SOLUTION. M. Eigen. Translated from Z. physik. Chem. (Frankfurt) (N. F.) 1, 176-200(1954). 38p.

A survey of theoretical fundamentals of the reaction kinetics of very rapid ion reactions in an aqueous solution is given. Calculations performed subsequently for the systems $NH_3$ and $H_2SO_4$ in aqueous solutions agree with experimental results within the limits of error. Thermodynamics and molecular statistical values only are used in these calculations. (W.L.H.)

**11923** AEC-tr-2973
GEOMETRIC ISOMERISM OF COMPLEX COMPOUNDS AND ABSORPTION SPECTRA OF THEIR SOLUTIONS IN THE UV REGION. A. V. Babaeva. Translated from Izvest. Sektora Platiny i Drug. Blagorod. Metal., Inst. Obshchei i Neorg. Khim., Akad. Nauk S.S.S.R. 25, 56-66(1950). 15p.

The absorption spectra in the ultraviolet region of some divalent platinum complexes such as diamines, diamine dihalides, and diamine nitrohalides are given and discussed. (T.R.H.)

**11924** AEC-tr-2983
RESEARCHES ON THE SUBHALIDES OF SOME ELEMENTS III. ON THE SO-CALLED SUBBROMIDE OF Bi(1). L. Marino and R. Becarelli. Translated by D. Cubiciotti from Atti accad. naz. Lincei 25, 105-11(1916). 4p.

**11925** AEC-tr-3000
SERIES OF VOLTAGES FOR HEAVY COLORED METALS AND THEIR SULFIDES IN FUSED CHLORIDES OF ALKALINE METALS. S. I. Remtel (S. E. Rennel) and I. N. Ozeryanya (E. N. Ozeryanga). Translated from Zhur. Fiz. Khim. 25, 1181-5(1951). 10p.

Measurements to establish the relative arrangement of heavy colored metals and their sulfides in a series of voltages in a fused equimolecular mixture of KCl and NaCl are presented. For this purpose it was sufficient to determine and compare either the electrode potentials with respect to the reversible comparison electrode, or the electromotive forces of the chemical chains. As comparison electrode the chlorine electrode was chosen, which is reversible with respect to the $MeCl_2/Cl_2$ anion and $Pb/PbCl_2$ cation. (W.L.H.)

**11926** AEC-tr-3010
RESEARCHES ON THE SUBHALIDES OF SOME ELEMENTS. V. ON THE SO-CALLED SUBCHLORIDE OF Bi. L. Marino and R. Becarelli. Translated by D. Cubicciotti from Atti accad. naz. Lincei 25, 221-7(1916). 3p.

**11927** AEC-tr-3015
ON THE MECHANISM OF FORMATION OF MERCURY-FREE ALLOYS IN AMALGAMATION REACTIONS. Franz Lihl and Herbert Kirnbauer. Translated from Z. Metallkunde, 48, 9-15(1957). 16p.

**11928** AEC-tr-3016
SOME PHYSICOCHEMICAL PROPERTIES OF COMPOUNDS OF THE TRANSITIONAL REFRACTORY METALS WITH BORON, CARBON, AND NITROGEN, AND THE CHARACTERISTICS OF THEIR BINARY ALLOYS. G. V. Samsonov. Translated from Izvest. Sektora Fiz. Khim. Anal. Inst. Obshchei Neorg. Khim., Akad. Nauk S.S.S.R. 27, 97-125(1956). 39p.

A study of the physico-chemical properties of the borides, carbides, and nitrides of Ti, Zr, Hf, Cr, Mo, W, V, Nb, and Ta was made to reveal information about bonding, interstitial phases, and properties of mixtures of these materials. (T.R.H.)

## ANALYTICAL PROCEDURES

**11929** NYO-2077
New York Operations Office. Health and Safety Lab., AEC. THE RADIUM CONTENT OF SOIL, WATER, FOOD, AND HUMANS: REPORTED VALUES. S. Allan Lough. Mar. 1957. 7p. $1.80(ph OTS); $1.80(mf OTS).

Data are tabulated on the Ra content of samples of soil, water, and food collected from various sources and determinations of the natural Ra content of the human body. (C.H.)

**11930** AEC-tr-2956
A NEW HIGHLY SELECTIVE METHOD FOR THE PHOTOMETRIC DETERMINATION OF ZIRCONIUM. H. Flaschka and M. Y. Farah. Translated from Z. anal. Chem. 152, 401-11(1956). 20p.

In the presence of complexon Zr forms an intensively colored complex with pyrocatechin violet, the absorption maximum of which is located at 620 mμ if an acetate-buffered solution of pH 5.2 is utilized. Photometric analysis of such solutions permits an accurate and highly selective determination of Zr. The absolute error in the case of Zr quantities between 3 to 60 μg exceeds the value of 1 μg only in the rarest cases with the use of half inch cells in a Coleman spectrophotometer. The standard curve is a straight line within the mentioned range. Compensating solutions are utilized which can be obtained by decolorizing the color complex formed in a portion of the sample solution by addition of $NH_4F$. The possibility is thus given to work with solutions which contain colored extraneous ions. Interference is caused only by Sb, Sn and $Hg^I$. For U, Y, Ti, Cr and Th the permissible quantity is limited to concentrations between 1 : 100 and 1 : 300 unless special precautions are taken for the elimination of errors conditioned by them. Other metals have been found to be ineffective in limiting concentrations of up to 1 : 3000 and beyond. Strong oxidizing agents as well as complex-forming anions must be removed. (auth)

**11931** AEC-tr-2999
ON THE ROLE OF THE FLAME TEMPERATURE IN FLAME PHOTOMETRIC ANALYSIS OF THE ALKALI METALS. E. Pungor, A. J. Hegedüs, I. Konkoly Thege, and E. E. Zapp. Translated from Mikrochim. Acta 7-8, 1247-63(1956). 16p.

Several disturbing phenomena encountered in the flame photometric analysis of alkali metals were studied theoretically and explained with respect to the processes in the flame. The effect on the emission of excitation, ionization, thermal dissociation, and other individual processes was cleared up to a considerable extent. Atomizing burners functioning in the immediate vicinity of the flame were recommended for flame photometric determinations, and also equipment provided with prisms or lattices, since such devices eliminate several disturbing colloid chemical parameters, which are difficult to survey. When the atomizing is done in connection with a deflector, the alcohol effect appears, namely, the form of the alcohol concentration-emission curve becomes dependent on the change in surface tension, although it results from the overlapping of several parameters. Likewise, in addition to the atomizing rate, the flame temperature plays the dominant role in the familiar calibration curves, with whose aid the most favorable combustion and atomizing mixtures are set up. Li and Na are only slightly ionized in the oxyhy-

drogen flame, so they do not interfere in the photometric determination of the alkali metals, and vice versa. In contrast, K, Ru, and Cs undergo considerable ionization in this flame, whereby the emission is increased through mutual repression of the ionization. By mixing N with the atomizing gas (oxygen), the flame temperature can be lowered by more than 1000° without change of the other parameters, and this averts the disturbance due to the ionization and so makes possible the analytical determination of the three latter elements. The effect of the flame temperature on the form of the calibration curves is especially striking in the case of Cs, whose calibration curve, because of temperature lowering, changes from an S-form into one having a saturation character. The anion influence is ascribed to the thermal dissociation of the sprayed salts or of those that form in the flame. (auth)

**11932** AEC-tr-3018

L-ASCORBIC ACID (VITAMIN C) AS A REAGENT. V. Lucas. Translated by K. S. Bevis from Anales real acad. farm. 17, 139-42(1951). 3p.

**11933**

X-RAY SPECTROGRAPHIC DETERMINATION OF CESIUM AND RUBIDIUM. J. M. Axelrod and Isidore Adler (U. S. Geological Survey, Washington). Anal. Chem. 29, 1280-1 (1957) Sept.

An x-ray spectrographic method for the determination of rubidium and cesium was developed, using the internal-standard method and a four-channel flat-crystal spectrograph. The sensitivity is within 0.1% for cesia and 0.02% for rubidia; the precision is within 10% of the amount present. Results agree well with those obtained by flame photometry and by radioactivation. (auth)

**11934**

DIRECT DETERMINATION OF OXYGEN IN ORGANIC COMPOUNDS. Irving Sheft and Joseph J. Katz (Argonne National Lab., Lemont, Ill.). Anal. Chem. 29, 1322-5(1957) Sept.

Oxygen can be obtained quantitatively from numerous organic compounds by heating with $BrF_2SbF_6$ at 500° C. It is essential that the reaction vessel be shaken vigorously to assure completion of the reaction. Oxygen has been quantitatively recovered from alcohols, aliphatic and aromatic acids, ethers, ketones, phenols, phosphate esters, sulfones, and organic nitrogen-containing compounds in which the oxygen is not bound directly to the nitrogen. This method of direct oxygen determination can be applied to solid, liquid, or gaseous samples. (auth)

**11935**

DETERMINATION OF INDIUM IN ROCKS AND MINERALS BY RADIOACTIVATION. A. A. Smales, J. van R. Smit, and H. Irving (A.E.R.E., Harwell, Didcot, Berks and Inorganic Chemistry Lab., Oxford). Analyst 82, 539-49(1957) Aug.

Neutron-activation analysis has been applied to the determination of traces of In, use being made of both the radionuclides $In^{114}$ and $In^{116}$. The ultimate sensitivity with irradiation in the Harwell Pile and use of 49-day $In^{114}$ is $8 \times 10^{-10}$ g. When there are facilities for chemical processing shortly after irradiation, it is possible to exploit the greater sensitivity of $5 \times 10^{-12}$ g afforded by the 54-minute isomer $In^{116}$. The radiochemical separations after the addition of carrier were based mainly on precipitations of indium as hydroxide and sulfide, together with stages of solvent extraction. Radiochemically pure In was finally precipitated and counted as the tris-oxinate; the chemical yield was determined gravimetrically. It was found to be essential to use dilute aqueous solutions of In in the standards irradiated simultaneously with the analytical samples to avoid errors due to self-shielding, which were shown to be serious when standards of In foil were used. The method has been applied to the determination of In in the standard rock samples G1 and W1, and in a number of separated minerals. (auth)

**11936**

DETERMINATION OF INDIUM IN CYLINDRITE BY NEUTRON-ACTIVATION ANALYSIS AND OTHER METHODS. H. Irving, J. van R. Smit, and L. Salmon (Inorganic Chemistry Lab., Oxford and A.E.R.E., Harwell, Didcot, Berks). Analyst 82, 549-58(1957) Aug.

Neutron-radioactivation analysis has been applied to the determination of In in the rare sulfide mineral cylindrite. Radiochemical separations were required in two procedures in which 49-day $In^{114}$ and 54-minute $In^{116}$, respectively, were used. However, analysis of the decay curve of a sample of cylindrite that had been irradiated with neutrons (for 1 second only) permitted the determination of its indium content without any chemical separations, and these were also avoided by the use of gamma-ray spectrometry. The four methods gave results in good agreement, viz., 0.146 ± 0.003, 0.141 ± 0.005, 0.15 ± 0.01, and 0.154 ± 0.003% of In. It has been shown, by using radiotracers, that no In is lost under conditions in which Sn and Sb can be volatilized quantitatively as their bromides, and that no In is co-precipitated with lead from sulfuric acid solutions. With this knowledge the quantitative separation of In from a 100-mg sample of cylindrite was achieved by a procedure that involved stages of solvent extraction with hydriodic acid, dithizone, and 8-hydroxyquinoline. The final absorptiometric determination as the tris-oxinate complex gave a value for the In content of cylindrite in good agreement with that found radiometrically. (auth)

**11937**

THE DETERMINATION OF CERIUM IN BISMUTH-BASE ALLOYS. M. C. Steele and L. J. England (Metal Manufactures Ltd., Port Kembla, N.S.W., Australia). Analyst 82, 593-7(1957) Aug.

**11938**

THE APPLICATION OF RADIOACTIVITY IN CHEMICAL ANALYSIS. T. Schönfeld and E. Broda. Atompraxis 3, 294-9(1957). (In German)

A brief review is presented of the application of radioactivity to chemical analysis. 301 references. (L.T.W.)

**11939**

STUDIES ON THE NEW HAMPSHIRE CHICKEN EMBRYO. VIII. GLYCOPROTEINS OF SERUM. Ole Arne Schjeide and Nancy Ragan (Univ. of California, Los Angeles). J. Biol. Chem. 227, 1035-41(1957) Aug.

**11940**

COLORIMETRIC DETERMINATION OF ZIRCONIUM IN TRACE ANALYSES. M. Pirš. "J. Stefan" Inst. Repts. (Ljubljana) 3, 175-8(1956) Oct.

A method for the determination of Zr in microgram quantities has been developed, based on the diminution of color intensity of a solution of p-dimethylaminoazophenylarsonic acid after precipitation of Zr. The method has been applied to the analyses of coal ashes, steels and bauxites. (auth)

**11941**

DETERMINATION OF RADON AND THORON IN AIR. G. B. Courtier (Public Health Department, London). Nature 180, 382-3(1957) Aug. 24.

**11942**

SEPARATION OF NIOBIUM AND TANTALUM WITH CUP-

FERRON. A. K. Majumdar and J. B. Ray Chowdhury. Naturwissenschaften 44, 420(1957).

**11943**

POLAROGRAPHIC DETERMINATION OF STRONTIUM. N. M. Selivanova and G. A. Zubova (Moscow Mendeleev Inst. of Chemistry and Technology). Zhur. Analit. Khim. 12, 466-8(1957) July. (In Russian)

Descriptions are given for the polarographic determination of Sr in aqueous solutions of its salts in concentrations >0.001 M. (tr-auth)

**11944**

USE OF ASCORBIC ACID IN AMPEROMETRIC TITRATION. I. DETERMINATION OF VANADIUM AND CERIUM IN THE PRESENCE OF OTHER ELEMENTS. Z. A. Gallaĭ, V. C. Triptsova, and V. M. Peshkova (Lomonosov Moscow State Univ.). Zhur. Analit. Khim. 12, 469-75(1957) July. (In Russian)

Ascorbic acid was oxidized on a rotating platinum electrode with the half-wave potential depending on the acidity of the solution and on the concentration of the reagent. The equality $I_d = KC$ is true for the concentration of solution up to $10^{-3}$N. The ascorbic acid solution, stabilized with complexone III and formic acid, may be successfully used as the reagent in amperometric titration with oxidation-reduction reactions. Ascorbic acid may be used for the determination of Va in pure salts and in the presence of Ni, Mn, Zr, Al, Cr, Ti, Fe, Mo, and W. A method was developed for the determination of Ce in pure salts, and conditions were found for amperometric determination of tetravalent Ce and trivalent Fe with ascorbic acid. (tr-auth)

**11945**

CONDUCTOMETRIC DETERMINATION OF WATER HARDNESS BY COMPLEXONE III. G. B. Pasovskaya (Turkmen Medical Inst., Ashkhabad). Zhur. Analit. Khim. 12, 523-5 (1957) July. (In Russian)

A conductometric method has been developed for accurate determination of hardness in turbid and colored waters. (tr-auth)

**11946**

BIBLIOGRAPHY OF POLAROGRAPHIC LITERATURE, 1922-1955. Chicago, E. H. Sargent & Co., 1956. 200p.

In this bibliography the list of publications follows alphabetical order by first author. Under each author papers are arranged chronologically. In cases where more than one paper was published by an author in one year, the papers are arranged alphabetically by the journal in which they were published. Each listing is numbered for use in conjunction with the subject index. The author's name is followed by the title of the paper. The journal or periodical in which the paper was published is printed in italics. The abbreviations of the periodicals conform with the authorized abbreviations as set forth in the list published by the American Chemical Society of periodicals abstracted by Chemical Abstracts. In cases where an abstract of the paper was available, the abstract reference appears after the listing. The abbreviation C.A. is used to stand for Chemical Abstracts, the semimonthly publication of the American Chemical Society. In some cases where the title does not denote the content of the paper, editorial notes have been included to provide this information. Authors other than first authors appear in the bibliography in the normal alphabetical order with cross references to their pertinent papers. These cross references also include all papers appearing in the addenda. The subject index of this bibliography constitutes a large section of this book. An introduction for that section appears at the beginning of the subject index. (auth)

## DEUTERIUM AND DEUTERIUM COMPOUNDS

**11947** CRC-713

Atomic Energy of Canada Ltd., Chalk River Project, Chalk River, Ont.

RELATIVE RATES OF REACTION OF THE ISOTOPIC SPECIES $H_2-HD-D_2$ WITH HYDROXYL RADICALS IN PERCHLORIC ACID SOLUTION. T. J. Hardwick. May 1957. 16p. (AECL-459).

The effect of temperature on the reaction $OH + H_2 \longrightarrow H_2O + H$ in aqueous solution has been studied. Substitution of hydrogen deuteride and deuterium for hydrogen increased the apparent activation energy of the reaction. The results suggest that the reaction occurs by H-H bond scission and not be the electron transfer $OH + H_2 \longrightarrow OH^- + H_2^+$. (auth)

## FLUORINE AND FLUORINE COMPOUNDS

**11948** AEC-tr-3013

THE PROBLEM OF PREPARING PURE BORON TRIFLUORIDE. M. I. Vinnik, G. B. Manelis, R. S. Ryabova, G. D. Tantsyrev, and N. M. Chirkov. Translated from Zhur. Neorg. Khim. 1, 628-31(1956). 7p.

A method is presented for synthesizing $BF_3$ by thermal decomposition of $KBF_3$ in the presence of $BaCl_2$ at temperatures of 650 to 700°C. (R.V.J.)

**11949**

QUALITATIVE AND SEMI-QUANTITATIVE DETERMINATION OF FLUORINE ION BY THE DROP METHOD. V. P. Gladyshev and G. A. Tolstikov (Kazakh State Univ., Alma-Ata). Zhur. Analit. Khim. 12, 567-8(1957) July. (In Russian)

A drop method for the detection of F ion based on the formation of a colored compound of F ion and iron ferrocyanide has been developed. The reaction is quite sensitive. A method for the rapid semi-quantitative determination of 0.5 to 10 mg/ml of F is described. (tr-auth)

## GRAPHITE

**11950**

HOLE AND CLAW DEFECTS IN GRAPHITE. A. R. Ubbelohde (Imperial Coll. of Science and Tech., London). Nature 180, 380(1957) Aug. 24.

**11951**

THE SLOW-NEUTRON CROSS-SECTION OF GRAPHITE. P. A. Egelstaff (Atomic Energy Research Establishment, Harwell, Berks). J. Nuclear Energy 5, 203-9(1957).

The slow-neutron cross section of a graphite block has been measured with the direction of extrusion at first parallel to the neutron beam and then at right angles to it. The results are analyzed by a new method to find an orientation function for the microcrystals. The magnitude of the orientation effects in the neutron cross section are about one-quarter those observed in the similar experiment by Arnold, Myers, and Weber (1949). The results are also analyzed to find the value of the inelastic scattering cross section. (auth)

## RADIATION CHEMISTRY

**11952**

RADIOCHEMICAL PROCEDURES FOR THE IDENTIFICATION OF THE MORE HAZARDOUS NUCLIDES. Bernd Kahn and Abraham S. Goldin (Oak Ridge National Lab., Tenn.). J. Am. Water Works Assoc. 49, 767-71(1957) June.

**11953**

MECHANISMS OF SIMPLE CHEMICAL REACTIONS PRODUCED BY IONIZING RADIATION. S. Ya. Pshezhetskiĭ and M. T. Dmitriev. Uspekhi Khim. 26, 725-67(1957) July. (In Russian)

Comparisons of the elementary initial processes with the characteristics of the subsequent chemical reactions reveal the importance of ionization, excitation, dissociation, and other processes in radiation-chemical reactions and explain the mechanisms of the reactions. Data are presented on such comparisons made for the simple radiation-chemical reactions of H, O, C, N, and their simple complexes. 215 references. (R.V.J)

**11954**

PROBLEMS IN RADIOCHEMISTRY. B. P. Nikol'skiĭ. Vestnik Akad. Nauk S.S.S.R. 27, No. 5, 103-5(1957) May. (In Russian)

The problems in radiochemistry including the state of microquantities of radioelements in solid and liquid phases, coprecipitation of radioelements with crystalline sedimentations, the value of complex compounds in radiochemistry, adsorption and ionic sorption, and distribution of radioactive substances between two liquid phases were discussed at the Soviet Union Conference of Radiochemistry, in Leningrad, March 5-9, 1957. (R.V.J.)

**11955**

PROBLEMS IN RADIATION CHEMISTRY. M. A. Proskurnin. Vestnik Akad. Nauk S.S.S.R. 27, No. 7, 98-101(1957) July. (In Russian)

Radiation chemistry of solutions, especially concentrated solutions, was discussed at the First All Union Conference of Acad. of Sciences Chemical Dept. with the Ministry of Chemical Industry, in Moscow, Mar. 25-30, 1957. (R.V.J.)

## RADIATION EFFECTS

**11956** KAPL-M-AAS-1

Knolls Atomic Power Lab., Schenectady, N. Y.

ORGANIC COOLANT IRRADIATION EXPERIMENT NO. 1. Experimental Data Obtained: December 1956-February 1957. A. A. Sugalski. June 1957. 33p. Contract W-31-109-Eng-52. $6.30(ph OTS); $3.00(mf OTS).

A 47 cc sample of mono-isopropyl biphenyl (MIPB) was exposed to a total neutron flux of $2.34 \times 10^{19}$ nvt and a fast neutron dose of $1.83 \times 10^{17}$ nvt at an estimated maximum temperature of about 815°F for approximately 4800 megawatt hours and 700°F for approximately 8500 megawatt hours in the Materials Testing Reactor at Arco, Idaho. The pressure in the slug was maintained between 250 and 450 psi; initially by a nitrogen cover gas and subsequently, as decomposition occurred, by bleeding the decomposition gases themselves, as pressure increased. The gas generation rate in the early high temperature period reached a maximum of about $3.5 \times 10^{-4}$ moles/hour-gram. Analysis of gas bled from the slug during the irradiation indicated that hydrogen and methane were the main gaseous decomposition products. Post-irradiation examination of the coolant at KAPL disclosed that the decomposition products were completely solidified. An unsuccessful attempt was made to melt the solid at 200°C. This damage to the coolant was more severe than anticipated and is undoubtedly due to the excessive temperature to which it was subjected. The experiment successfully proof-tested an in-pile slug design capable of providing coolant stability data during irradiation. (auth)

**11957** KAPL-M-CTL-1

Knolls Atomic Power Lab., Schenectady, N. Y.

DYNAMIC IRRADIATION OF CADMIUM-INDIUM-SILVER ALLOY. C. T. Lohrey. June 17, 1957. 14p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

As a proof test of the Cd-In-Ag alloy, it is planned to irradiate, in a dynamic coolant closely approximating SAR conditions, samples cut from extruded Cd-In-Ag stock. Extrusion is the anticipated method of manufacturing of control rods of this material. The basic material is the 5 wt. % Cd, 15 wt. % In, 80 wt. % Ag alloy. The irradiation is to be in the MTR. Three types of information are desired from this particular test: corrosion and erosion effect on the transmuted alloy; a correlation between "burnup", the transmuted alloy, and corrosion; and an indication of gross mechanical property changes which might be unique under SAR operating conditions. (auth)

**11958** NP-6397

Shell Development Co., Emeryville, Calif.

RESEARCH ON DETERMINATION OF THE STABILITY OF JET ENGINE FUELS. Quarterly Progress Report No. 3 [for] period March 1 through May 31, 1957. Harry B. Minor, Alan C. Nixon, and Roy E. Thorpe. 58p. Contract AF33(616)-3888. (S-13727).

Continuing the study of the action of ionizing radiations on jet fuels, the effects of gamma dosage on fuel properties are being determined. In so far as many of the usual chemical and physical properties are concerned, a comparatively rapid rate of change occurs in the high dosage region ($10^8$ to $10^9$r) but the values for the unirradiated samples are approached asymptotically as dosage is decreased. At best, changes in properties first become significant at $3 \times 10^7$r. Certain properties, such as heat of combustion, are less sensitive to dosage level owing to the magnitude of the experimental errors involved in their determination. Separation by boiling range and component type of a radiation-unstable JP-4 fuel, RAF-107, made from San Joaquin crude has shown that despite the fact that each of the components evaluated thus far (saturate, low-boiling, and high-boiling fractions) is markedly more stable than the whole fuel before irradiation, a dosage of $1 \times 10^9$r reduces filter-plugging-times in the Shell High Temperature Stability Rig at 450°F to nearly the same level in each case. It therefore appears that the saturates themselves, which comprise 84%v of this fuel, may limit its radiation stability. The investigation of the radiolysis of decalin is continuing. At a gamma dose of $10^9$r in an air environment about 65%v of the decalin remains unreacted. The major reaction products are cyclic olefins and di-, tri- and tetradecalyl and related compounds containing one or more double bends. There is some ring-opening, and polymeric oxygenated compounds of high molecular weight are also formed. Although the polymeric types of radiolysis products characteristic of decalin irradiated to $1 \times 10^9$r are bound to create misgivings in connection with their filter-plugging tendencies, the choice of saturates as auxiliary fuels for nuclear aircraft is still justifiable. The three CRC fuel samples exposed to SPT irradiation in their original steel containers were found to have higher soluble iron contents than when received. The soluble iron may then catalyze oxidation reactions at high temperatures thus bringing about the pronounced loss of thermal stability which was observed earlier with these fuels in both the CFR Fuel Coker and the Shell Development laboratory heat exchanger test. Tests have been made in both the aforementioned units to select a dispersant additive for a blend to be subjected to full-scale engine test at WADC. A Shell commercial fuel oil additive and an experimental material have given good performance in both the once-through Fuel Coker and the recycle Shell test. DuPont's JFA No. 5 was more effective in the Coker than in the Shell unit,

whereas their FOA No. 2 gave the opposite result. Six CRC fuels were found to be very stable with respect to formation of gum and peroxides during one year's storage at 43°C under air. (For preceding period see NP-6363.) (auth)

**11959** NP-6406

Esso Research and Engineering Co., Linden, N. J.

NUCLEAR RADIATION RESISTANT TURBINE ENGINE LUBRICANTS. Quarterly Progress Report No. 5 [for] February 1 to May 1, 1957. Alfred H. Matuzak. June 14, 1957. 26p. Contract AF-33(616)-3181. (RL-4M-57).

The development of radiation-resistant turbine engine lubricants for nuclear power plants is reported. It is a continuation of work in which finished lubricants or formulation modifications thereof and inhibited base stocks are being screened as potential irradiation-resistant lubricants or lubricant base stocks. Screening of these materials is being conducted mainly at $10^8$ roentgens. The more promising materials will then be investigated at higher gamma dosages before selecting base stocks for final lubricant formulations. The initial effort to develop a radiation-resistant base stock from aromatic esters is presented. Because aromatic materials are reported to be more resistant to irradiation than the corresponding aliphatic materials, particular emphasis is being placed on aromatic ester base stocks derived from benzenedicarboxylic acids—phthalic, isophthalic, and terephthalic acids. These acids and their methyl esters are readily available from commercial sources and serve as starting materials in synthesizing their esters. Based on the present work, the diesters and complex esters made from tridecyl ($C_{13}$ Oxo) alcohol and these aromatic acids appear to be more resistant to $10^8$ roentgens than the corresponding sebacates, azelates, etc. Of the base stocks evaluated during the fifth quarter, di-tridecyl terephthalate and its complex ester are the most promising based on over-all physical properties. The above aromatic esters along with several previously tested materials. To date certain mineral oils appear to be the most irradiation resistant and hence the most promising of the materials thus far evaluated under the contract. (auth)

**11960** WAPD-CTA(EC)-305

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

EFFECTS OF RADIATION AND CONTAMINATION ON A POLYESTER RESIN PROTECTIVE COATING. Ned J. Clayton. [Feb. 1957]. 61p. $10.80(ph OTS); $3.90(mf OTS).

The radiation stability tests conducted on the test panels covered with Liquid Tile coating confirms available data indicating that the material will not break down when subjected to a total gamma radiation dose of $10^9$ R. The slight discoloring of the white surface was not considered to be detrimental to the use of the material as a protective coating for the Expended Core Facility water pits. The decontamination tests indicate that the smooth Liquid Tile surfaces are easily cleaned and decontaminated of fission product activity by using ordinary janitorial procedures. (auth)

**11961**

THE EFFECT OF X-RAY EXPOSURE ON DEOXYRIBONUCLEASE. II. ACTIVITY IN LYMPHOID TISSUES. S. Okada, E. R. Gordon, R. King, and L. H. Hempelmann (Univ. of Rochester, N. Y.). Arch. Biochem. Biophys. 70, 469-76(1957).

**11962**

DECOMPOSITION OF NITRIC OXIDE AND NITROGEN DIOXIDE BY THE IMPACT OF FISSION FRAGMENTS OF URANIUM-235. P. Harteck and S. Dondes (Rensselaer Polytechnic Inst., Troy, N. Y.). J. Chem. Phys. 27, 546-51(1957) Aug.

A study was made of the decomposition of nitric oxide and nitrogen dioxide using the fission recoil energy of 5 mg of $U^{235}$ oxide powder. The irradiations were conducted in a 23-cc quartz vessel, at a flux of $3 \times 10^{12}$ neutrons/cm$^2$ second, and at a temperature of 70°C in the Brookhaven National Laboratory Reactor. With a dose of $2 \times 10^9$ r, the over-all $G_{NO}$ is $9.5 \pm 1.0$, using a radiation intensity of $1.0 \times 10^7$ r/min, a filling pressure of 500 mm at 21°C. With a dose of $10^8$ r, the $G_{NO}$ is $13.8 \pm 1.4$. Since three additional nitric oxide molecules are consumed for each nitric oxide molecule decomposed at $10^8$ r, the $G_{NO}$ value calculated for the primary decomposition (including the dissociation due to ion-recombination) is $3.45 \pm 0.35$. The $G_{NO_2}$ value is 1.2 for a dose of $3 \times 10^9$ r and 0.5 for $5 \times 10^7$ r, conducted under a radiation intensity of $1.2 \times 10^7$ r/min and a filling pressure of 550 mm of the $2\,NO_2 \rightleftharpoons N_2O_4$ equilibrium at 21°C. For the principal reactions in the nitric oxide and nitrogen dioxide systems, when irradiated with ionizing radiation, a reaction mechanism is proposed which seems to explain the characteristic features of the system. (auth)

**11963**

EFFECT OF IONIZING RADIATION ON SOLID CATALYSTS. R. W. Clarke and E. J. Gibson (Fuel Research Station, London). Nature 180, 140-1(1957) July 20.

**11964**

RADIATION EFFECTS ON AQUEOUS THIOUREA SOLUTIONS. W. M. Dale and J. V. Davies (Christie Hospital and Holt Radium Inst., Withington, Manchester, Eng.). Radiation Research 7, 35-46(1957) July.

**11965**

SQUARE BUBBLES IN IRRADIATED AND ANNEALED LITHIUM FLUORIDE CRYSTALS. Peter Senio (Knolls Atomic Power Lab., Schenectady, N. Y.). Science 126, 208(1957) Aug. 2.

## RARE EARTHS AND RARE-EARTH COMPOUNDS

**11966**

THE COMPLEXING OF CERIUM(III), LANTHANUM(III) AND GADOLINIUM(III) BY FLUORIDE IONS IN AQUEOUS SOLUTION. J. W. Kury, Z. Z. Hugus, Jr., and W. M. Latimer (Univ. of California, Berkeley). J. Phys. Chem. 61, 1021(1957).

## SEPARATION PROCEDURES

**11967** AECD-3768

Union Carbide and Carbon Research Labs., Niagara Falls, N. Y.

EXPERIMENTATION ON THE EXTRACTION OF URANIUM FROM WESTERN ORES BY LEACHING WITH SODIUM CARBONATE AND SODIUM BICARBONATE. E. R. Saunders and M. C. Carosella. Dec. 3, 1943. Changed from OFFICIAL USE ONLY Jan. 23, 1957. 11p. $3.30(ph OTS); $2.40(mf OTS). (M-4756).

The results of a number of tests designed to find the optimum conditions for leaching Colorado-Utah Sandstones in order to obtain the maximum $U_3O_8$ extraction with minimum $V_2O_5$ extraction are given. The tests confirm previous tests and show that 90 to 95% of the $U_3O_8$ can be extracted with less than 10 to 15% of the $V_2O_5$. Temperatures over 95°C, extraction times of more than one hour, soda ash concentrations of more than 12%, were

found to give the best results. The effect of particle size between 14 and 60xD was very marked. Bicarbonate did not give as good extractions as carbonate on an equal weight basis. Countercurrent extraction was demonstrated to be a satisfactory method of building up the concentration of the solutions if the alkali concentration is maintained. Soda ash economy with soda ash concentration can be obtained by using high ore to water leaching ratio. Filterability of the ore pulps was not as much of a problem as previous tests had indicated it would be. (auth)

**11968** BNL-457
Brookhaven National Lab., Upton, N. Y.
PILOT PLANT FLUORINATION OF URANIUM FUEL ELEMENTS BY BROMINE TRIFLUORIDE. G. Strickland, F. L. Horn, and R. Johnson. July 26, 1957. 54p. Contract [AT-30-2-gen-16]. $9.30(ph OTS); $3.60(mf OTS).

Fluoride Volatility Processes are nonaqueous methods of processing irradiated fuel elements. In each of these methods, the U is fluorinated to $UF_6$ and then decontaminated by distillation. One of the methods, involving direct fluorination of the U by $BrF_3$, has been under investigation at BNL since 1950; subsequently a pilot plant was built to study this step of the process. The objectives of the program were to investigate the technical feasibility of continuous dissolution and to determine the effect of process variables on the capacity of the equipment; namely, the effect of temperature, solution composition, flow rate, and uranium history on dissolving time as related to fuel elements of the types used at BNL, ORNL, and Hanford. The nominal capacity of the dissolver was 5 lb of U per hour, and all process equipment was fabricated of Monel. Special equipment components and numerous safety features were utilized. The major equipment development was a canned-rotor pump used for circulation of the dissolver stream through the heat exchanger. A system for continually charging slugs to the pressurized dissolver was also developed. Operation consisted of batch runs which were made with unirradiated BNL slugs in order to gain information useful in the planning of continuous runs. Eight runs were made at 120°C, starting with pure $BrF_3$ and progressing to solutions containing 4 mole % $UF_6$. Practical dissolution rates were obtained, and it was found that $UF_6$ increases the dissolution rate. Its effect in reducing slug dissolution time was very marked at concentrations up to 1 mole %, became increasingly less in the 1 to 2% range, and had no effect in the 2 to 4% range. (auth)

**11969** BNL-3334
Brookhaven National Lab., Upton, N. Y.
DEVELOPMENT OF AQUEOUS PROCESSES FOR HEAD END TREATMENT OF FUELS FROM THE POWER REACTOR DEMONSTRATION PROGRAM. C. W. Pierce and B. Manowitz. July 1957. 19p. Contract [AT-30-2-gen-16]. $3.30(ph OTS); $2.40(mf OTS).

The wide diversity of fuels resulting from the Power Reactor Demonstration Program presents many problems in reactor fuel reprocessing. In order to minimize the initial investment necessary to change over and convert existing facilities to handle these new fuels, aqueous processes will be desirable. This report summarizes an approach to cope with these problems emphasizing aqueous head end processes. (auth)

**11970** CF-57-6-87
Oak Ridge National Lab., Tenn.
THE VOLATILIZATION OF FISSION PRODUCTS BY MELTING OF REACTOR FUEL PLATES. George W. Parker and George E. Creek. July 15, 1957. 22p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

Experiments in the controlled melting of irradiated fuel specimens, particularly of the APPR, STR, and MTR types have been confirmed that prolonged heating in air at temperatures in excess of the melting point results in the release of a large portion of the radioactivity. On the other hand, a moderate amount of heating in air or steam sufficient only to melt a specimen results mainly in the partial volatilization of the rare gases; the halogens, $I_2$ and $Br_2$; and the alkali metals, Cs and Rb. In the presence of air or water vapor, Sr and other fission products are not released. At trace concentration of fission products, slow melting of the APPR plate at 1525°C in air or steam effected the release of 50% of the rare gases, 33% of the $I_2$, 9% of the Cs, and traces of Sr. After 25% burn-up, the Cs value increased to about 60%. Aluminum alloy of the MTR type, also at trace concentration, upon melting at 700°C released up to 2% of the $I_2$, 10% of the rare gases, and negligible portions of other fission products. Zirconium alloy of the STR type after 15% burn up, when melted at 1850°C, released up to 95% of the rare gases, 90% of the Cs, 60% of the $I_2$, and only a trace of Sr. (auth)

**11971** HW-29967 A
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
APPLICATION OF THE PACKED COLUMN TO THE REDOX PROCESS. E. R. Irish. Mar. 12, 1957. 21p. Contract W-31-109-Eng-52. $0.20(OTS).

A brief description is presented of the Redox process for Pu and U separation and decontamination from fission products contained in irradiated U fuel elements. Performance characteristics determined for packed solvent extraction columns during development work are discussed. These characteristics are interrelated and include processing capabilities, mass transfer effectiveness, and operating peculiarities. Instrumentation for control and observation of performance is described briefly. Inherent difficulties which may be encountered in such equipment operation can be minimized by adequate operating techniques and equipment design, so that excellent performance may be obtained. (auth)

**11972** HW-49483 A
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
THE PUREX PROCESS--A SOLVENT EXTRACTION REPROCESSING METHOD FOR IRRADIATED URANIUM. E. R. Irish and W. H. Reas. Apr. 8, 1957. 33p. Contract W-31-109-Eng-52. $0.60(OTS).

The Purex Process, which employs solvent extraction to separate and purify U and Pu from each other and from fission products contained in irradiated U fuel elements is described. A description of the over-all process, utilizing tri-butyl phosphate solvent (in a kerosene-type diluent) and $HNO_3$ salting agent, is provided along with chemical process flowsheets. The process chemistry of U, Pu, and fission products is discussed as affected by process variables. Methods of recovery of spent solvent and acid are briefly discussed. Alternate process arrangements are suggested. (auth)

**11973** HW-49542 A
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
APPLICATION OF THE PULSE COLUMN TO THE PUREX PROCESS. R. G. Geier. Apr. 5, 1957. 33p. Contract W-31-109-Eng-52. $0.30(OTS).

General aspects, including the effects of factors influencing performance, of pulsed solvent extraction columns are described. The original design concept, i.e., H.T.U. requirements, column heights, cartridge geometry, and

expected operable volume velocities of the pulse columns for use in the Purex process, is presented. Subsequent improvements in column internals resulting from development studies directed toward extending the range of column operability by increasing amplitude-frequency limitations and/or reversing the choice of continuous phase are also included. (auth)

**11974** HW-49544 A

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

REMOVAL OF FISSION PRODUCTS FROM FEEDS. M. K. Harmon. Apr. 3, 1957. 21p. Contract W-31-109-Eng-52. $0.35(OTS).

An auxiliary pre-treatment step in the preparation of a feed solution for solvent extraction separations processes has been developed which can be used for removing most of the three most troublesome fission products, Ru, Zr, and Nb. Oxidation by means of ozone will allow removal of 90% or more of the Ru, and oxidation by means of $MnO_4^-$ followed by scavenging with the resulting $MnO_2$, will allow removal of 90% or more of all three fission products. A wide variety of actual process steps is available and considerable latitude in conditions of time, temperature, concentration, and so forth, is possible to suit the individual needs of specific applications. In addition to the direct benefits of this fission product removal prior to the start of solvent extraction, an improvement in decontamination subsequently achievable during solvent extraction also results from the pre-conditioning of the fission products (principally Ru) during the treatment itself. It is necessary to recognize, however, that the volatilization of fission products from dissolver solution in multi-curie amounts does present its own special and potentially serious problems to be solved with respect to design for complete containment and proper handling of such radioactive gases. (auth)

**11975** HW-49549 A

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

TREATMENT OF GASEOUS EFFLUENTS. W. C. Schmidt. Apr. 10, 1957. 26p. Contract W-31-109-Eng-52. $0.25 (OTS).

Equipment for the removal of noxious radioactive waste gases from chemical processing facilities is described. The discussion is separated into two parts to describe the equipment necessary for the removal of particulate radioactivity present as an aerosol and the other radioactivity which is present as a true gas. As the discussion develops on the decontamination of the waste gases, actual data and empirical equations for design calculations are presented. Also presented is a short section on the difficulties experienced in operating the equipment as described. (auth)

**11976** HW-49597 A

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

CONVERSION CHEMISTRY OF PLUTONIUM NITRATE. K. M. Harmon and W. H. Reas. Apr. 11, 1957. 25p. Contract W-31-109-Eng-52. $0.25(OTS).

The process steps in the conversion of plutonium nitrate–nitric acid solutions to Pu metal are given. (W.L.H.)

**11977** HW-51386

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

PERFORMANCE OF A TURBOMIXER FOR CONTINUOUS WASHING OF PUREX ORGANIC. J. J. Shefcik. July 3, 1957. 11p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

A turbomix unit using a 12-in.-diam. four-bladed paddle with 3-in.-wide blades rotating at approximately 200 rpm within an 18-in.-diam. draft tube should provide satisfactory washing of Purex Plant organic. (auth)

**11978** ISC-841

Ames Lab., Ames, Iowa.

PYROMETALLURGICAL SEPARATION OF URANIUM FROM THORIUM. Premo Chiotti and H. E. Shoemaker. [Mar. 21, 1957]. 24p. Contract W-7405-eng-82. $4.80 (ph OTS); $2.70(mf OTS).

The purpose of the present investigation was to study the equilibrium phases existing in the Mg-rich end of the ternary Mg–Th–U system and to evaluate these results in terms of possible pyrometallurgical methods for separating U from Th. Particular emphasis was placed on the determination of the solubility of U in Mg, Mg–16 wt. % Th, and Mg–35 wt. % Th solutions. The solubility of U in these liquids at 650°C is 0.002, 0.004, and 0.007 wt. %, respectively. The solubility at 1132°C in each case is 0.17, 0.14, and 0.14 wt. %, respectively. At just above the melting point of U (1132°C), two liquid phases are formed, a Mg-rich liquid containing most of the Th and a U-rich liquid containing 99 or more wt. % U. Two liquid phases can be formed at 860°C by adding enough Cr to form U-5.2 wt. % Cr eutectic. The results indicate that it should be possible to separate U from a U–Th mixture by extracting the Th with Mg. (auth)

**11979** MLM-664

Mound Lab., Miamisburg, Ohio.

THE DISTILLATION OF POLONIUM FROM LIQUID BISMUTH. Interim Report. R. W. Moshier and S. Barth. Feb. 1, 1952. Decl. July 18, 1957. 17p. Contract AT-33-1-gen-53. $3.30(ph OTS); $2.40(mf OTS).

Concentration of Po from irradiated Bi by distillation is reported. Precise information is required to establish the relation between the experimental conditions employed and the enrichment factor obtained in order to select the best conditions for still operation. Particular attention has been given to the effect of temperature, pressure, surface condition of the Bi, additives and the rate of distillation. Distillations were conducted at definite temperatures between 550 and 835°C. The enrichment factor is calculated from the equation. (auth)

**11980** WIN-86

National Lead Co. Raw Materials Development Lab., Winchester, Mass.

OXIDANTS IN CARBONATE LEACHING OF URANIFEROUS ORES. P. J. Magno and M. A. DeSesa. Aug. 23, 1957. 44p. Contract AT(49-6)-924. $7.80(ph OTS); $3.30(mf OTS).

In order to obtain data on the comparative effectiveness of oxidants for U in alkaline carbonate solutions, a variety of reagents were used under identical conditions for the dissolution of $UO_2$ in 0.5M $Na_2CO_3$ and 0.5M $NaHCO_3$. Those oxidants which appeared most promising were evaluated further in leaching studies on E. L. Cord and La Sal ore samples. As a result of these tests, the cupric ammonia complex ion was determined to be the most economical oxidant for the carbonate leaching of uraniferous ores. Further evaluation of the copper–ammonia reagent on other ores, which were known to require an oxidant during carbonate leaching, indicated that this reagent is effective on all ores tested. (auth)

**11981** AEC-tr-2996

THE STRUCTURE AND MODE OF ACTION OF ION EXCHANGE AGENTS. H. Deuel and K. Hutschneker. Translated by M. H. Rand from Chimia Switz. 9, 49-65(1955). 36p.

Ion exchangers are characterized as insoluble polyelectrolytes. Their accompanying ions of opposite charge are easily exchanged by the simple process of separating the insoluble particles of the ion exchanger from the solution, the phenomenon of exchange can be utilized for the separation of ions. The characteristics and several representative types of ion exchange reactions are outlined. An asymmetric distribution of a given ion between the exchange agent and the solution is often observed; it is only because of this phenomenon that ion exchange resins have such importance. (auth)

**11982**

THE SEPARATION OF URANIUM FROM LARGE AMOUNTS OF IRON AND ALUMINIUM BY ANION EXCHANGE IN NITRATE MEDIA. Heather M. Ockenden and J. K. Foreman (U.K.A.E.A., Windscale Works, Sellafield, Calderbridge, Cumberland). Analyst 82, 592-3(1957) Aug.

**11983**

FUEL ELEMENT REPROCESSING. L. Koren Lund (J.E.N.E.R., Kjeller, Norway). Atomics 8, 333-5(1957) Sept.

A pilot plant built at JENER to reprocess fuel elements is described. (M.H.R.)

**11984**

AN IMPROVED PROCESS FOR THE PRODUCTION OF URANIUM METAL. I. ION EXCHANGE. A. Cacciari, R. De Leone, C. Fizzotti, and M. Gabaglio (CISE Labs., Milano). Energia nucleare (Milan) 4, 222-30(1957) June.

**11985**

ELECTROLYTIC PREPARATION OF TITANIUM FROM FUSED SALTS. I. PRELIMINARY ELECTROLYTIC STUDIES WITH DIAPHRAGMED CELLS. Marshall B. Alpert, Frank J. Schultz, and William F. Sullivan (National Lead Co., Sayreville, N. J.). J. Electrochem. Soc. 104, 555-9(1957) Sept.

Reduced titanium chlorides dissolved in fused alkali and alkaline earth chlorides may be electrolyzed in diaphragmed cells under an inert gas atmosphere to yield ductile titanium as adherent, crystalline deposits. The reduced titanium chlorides are prepared in situ by adding $TiCl_4$ through a hollow cathode at a controlled feed-to-current ratio. (auth)

**11986**

THE ISOLATION OF $^{234}$Th FROM URANYL NITRATE. L. Kosta. "J. Stefan" Inst. Repts. (Ljubljana) 3, 157-61 (1956) Oct.

Two methods for the isolation of $Th^{234}(UX_1)$ from $UO_2(NO_3)_2$ are described. By the first procedure the Th isotope is extracted with mesityloxide. The final solution of the Th isotope when applying this method, contains some Al used during the extraction as the salting out agent. The second procedure based on the coprecipitation of Th with Bi hypophosphate is appropriate for the preparation of carrier free solutions of the isotope. (auth)

**11987**

NEW METHOD FOR THE ISOLATION OF MICROGRAM AMOUNTS OF THORIUM FROM COMPLEX MIXTURES. L. Kosta. "J. Stefan" Inst. Repts. (Ljubljana) 3, 163-70 (1956) Oct.

Quantitative carrying down of Th with Bi hypophosphate from highly acid solutions has been observed during an investigation involving the coprecipitation of Th traces with different hypophosphates. On reducing Bi to the metallic state with alkaline formaldehyde solution it was noted that Th was quantitatively retained by the metal thus formed. Based on this behavior a rapid method has been devised for the determination of Th in complex mixtures using a La fluoride–Bi hypophosphate coprecipitation cycle. The method gives very satisfactory results when analyzing different types of ores containing Th in concentration range between 0.1 and 0.005%. All steps in the proposed procedure have been controlled by radiometric measurements using $Th^{234}$ as tracer. The whole separation procedure including the decomposition of the sample can be carried out in a few hours. (auth)

**11988**

PAPER CHROMATOGRAPHIC SEPARATION OF ZIRCONIUM AND THORIUM. D. Lebez and M. Pirš. "J. Stefan" Inst. Repts. (Ljubljana) 3, 171-3(1956) Oct.

The paper chromatographic separation of Zr and Th is described. The solvent rendering such a separation practicable is an aceton 5% water-solution of oxalic acid in a proportion of 100:26 to 32. The $R_f$ values for either elements, and the optimum boundary between them, are specified. (auth)

## SORPTION PHENOMENA

**11989** NBS-5044

National Bureau of Standards. Cryogenic Engineering Lab., Boulder, Colo.

ADSORPTION OF NITROGEN FROM HYDROGEN GAS STREAMS ON SILICA GEL AT LOW TEMPERATURES. Technical Memorandum No. 42, W. T. Ziegler. Jan. 24, 1957. 29p. NBS Project No. 8120-12-8629. $4.80(ph OTS); $2.70(mf OTS).

The paper examines in a preliminary manner the problem of designing adsorption purifiers for removing difficultly condensible impurities such as $N_2$, CO, A, $CH_4$, $O_2$ from hydrogen gas streams. Detailed calculations are presented only for nitrogen. The assumption is made that the purifier is operated under equilibrium conditions, that is, the adsorption front is sharply defined. This condition is probably not met in practice because of kinetic effects, so that the capacity calculated using the equilibrium theory may be expected to be larger than one finds in practice. These kinetic effects will be examined in a later paper. Limited data available for the capacity of the silica gel purifiers used in the NBS liquid hydrogen plant at Boulder, Colorado, are shown to be in approximate agreement with results predicted from theory. (auth)

**11990** AEC-tr-3008

STUDIES OF THE POROUS STRUCTURE OF SOLIDS BY SORPTION METHODS. I. ANALYSIS OF VARIOUS METHODS FOR COMPUTING THE DISTRIBUTION OF PORE VOLUME. M. M. Dubinin. Translated from Zhur. Fiz. Khim. 30, 1652-61(1956). 23p.

A comparative analysis of various methods for computing the distribution of pore volume and surface by size for porous sorbents on the basis of sorption measurements is given. The particular features of each method are discussed, and in separate cases physical foundations are provided for the limits of application of the method. (W.L.H.)

**11991**

ADSORPTION OF HYDROGEN ON NICKEL LAYERS CONDENSED IN HIGH VACUUM. N. N. Kavtaradse (Inst. of Physical Chemistry, Acad. of Sciences, U.S.S.R.). Doklady Akad. Nauk. S.S.S.R. 114, 822-5(1957) June 1. (In Russian)

The reported data showed that the $H_2$ adsorption on Ni and on Fe, Cr, and Pt is a complex process composed of reversible and nonreversible parts. The reversible part depends strongly on the pressure and temperature, while

the nonreversible part depends basically on the temperature. The effect of the pressure on the magnitude of adsorption in the studied range of pressure was not detected. (R.V.J.)

## SPECTROSCOPY

**11992** AERE-C/R-2163
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
DESIGN OF A 21 FT. SPECTROGRAPH USING A PLANE GRATING. PART II. THE GRATING IN PARALLEL LIGHT. THEORETICAL CONSIDERATIONS. E. W. T. Richards, A. R. Thomas, and W. Weinstein. Jan. 1957. 14p.

## TRACER APPLICATIONS

**11993**
RADIOISOTOPES AS TRACERS IN CHEMICAL RESEARCH. A. Scaroni. Energia nucleare (Milan) 4, 173-81(1957) June. (In Italian)

A brief review of the field of kinetics is given with particular regard to isotopic exchange reactions in the field of chemical structure and the study of reaction mechanisms. The study of the process of self-diffusion and the analytic applications, in particular analysis by isotopic dilution and activation, are discussed. (tr-auth)

**11994**
THE METABOLISM OF THE ESSENTIAL FATTY ACIDS. VI. DISTRIBUTION OF UNSATURATED FATTY ACIDS IN RATS ON FAT-FREE AND SUPPLEMENTED DIETS. James F. Mead (Univ. of California, Los Angeles). J. Biol. Chem. 227, 1025-34(1957) Aug.

**11995**
HEIDELBERG NATURAL RADIOCARBON MEASUREMENTS I. K. O. Münnich (Univ. of Heidelberg, Germany). Science 126, 194-6(1957) Aug. 2.

Data are presented on the natural radiocarbon content of fossil organic material, wood, and bone samples. Proportional counting of carbon dioxide with a gas pressure of roughly one atmosphere was used in making the measurements. A standard based on 19th century wood was used, and a value of 5568 years was used for the half-life of $C^{14}$. (C.H.)

**11996**
STOCKHOLM NATURAL RADIOCARBON MEASUREMENTS I. H. G. Ostlund (Swedish Geological Survey, Stockholm). Science 126, 493-7(1957) Sept.

Data are tabulated on the age of various archeological specimens as determined by $C^{14}$ counting. The samples were converted to extremely pure carbon dioxide, and a proportional-counting tube was used in the measurements. (C.H.)

## TRANSURANIC ELEMENTS AND COMPOUNDS

**11997** HW-49441 A
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
PERFORMANCE OF A PLUTONIUM REFLUX SOLVENT EXTRACTION SYSTEM. B. F. Judson. Mar. 27, 1957. 13p. Contract W-31-109-Eng-52. $0.20(OTS).

The operability of product refluxing in a Pu solvent extraction system has been demonstrated on a semi-works scale. Although the mechanisms involved are not completely understood, operating experience has shown that the refluxing technique presents definite advantages in terms of over-all processing flexibility and the reduction in the number of process steps required to attain Pu concentrations of up to 100 grams per liter. The high Pu concentrations present in a reflux system, however, result in certain equipment design problems and also accelerate solvent degradation with its associated problem of "unstrippable" Pu. Despite these disadvantages, product refluxing may be considered as an efficient and practical technique for providing concentrated Pu solutions. (auth)

## TRITIUM AND TRITIUM COMPOUNDS

**11998** NBS-C-562(Suppl. 1)
National Bureau of Standards, Washington, D. C.
BIBLIOGRAPHY OF RESEARCH ON DEUTERIUM AND TRITIUM COMPOUNDS [FOR] 1953 AND 1954. Virginia R. Johnson, Lawrence M. Brown, and Abraham S. Friedman. July 15, 1957. 34p. $0.25(GPO).

A bibliography of 720 references to published research on the properties of deuterium and tritium compounds is given. The subject matter of each entry in the bibliography is indicated by letter codes related to a list of broad subject headings as shown in the Introduction. An index of deuterium and tritium compounds and a subject index are included. (auth)

## URANIUM AND URANIUM COMPOUNDS

**11999** HW-49652 A
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
CONTINUOUS CALCINATION EQUIPMENT FOR CONVERTING UNH TO $UO_3$. R. G. Geier. Apr. 12, 1957. 17p. Contract W-31-109-Eng-52. $0.20(OTS).

The continuous conversion of UNH to $UO_3$ in an agitated trough calciner has been demonstrated. A description of a pilot plant unit is presented. The range of operating conditions tested and their influence on $UO_3$ quality and pilot plant equipment operability are discussed. (auth)

**12000** WAPD-TM-73
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
RÉSUMÉ OF URANIUM OXIDE DATA—X. J. Belle and L. J. Jones. Aug. 15, 1957. 81p. Contract AT-11-1-GEN-14. $12.30(ph OTS); $4.50(mf OTS).

The preparation and characterization of $UO_2$ powders and the effects of ball-milling and steam on the sintering of $UO_2$ are discussed. Investigations of $UO_2$ stability in water, $UO_2-O_2$ equilibrium and kinetics, $O_2$ diffusion in $UO_2$, and the inert gas fission products of $UO_2$ are also reported. In the $UO_2$ irradiation program, fusion and grain growth in $UO_2$ and the effect of high burnup on PWR blanket rods were studied. Reports of studies conducted at KAPL on sintering binary $UO_2$ mixtures with $CeO_2$, $ZrO_2$, $Nb_2O_5$, and $PuO_2$ and studies at BMI on the effect of structure and $N_2$ content on $UO_2$ prepared from various sources are presented. A paper on the irradiation of swage-compacted $UO_2$ fuel rods is included. (For preceding period see WAPD-TM-44.) (T.R.H.)

**12001**
CRYSTALLOGRAPHIC DATA: URANIUM TETRAFLUORIDE, $UF_4$. Jagdish Shankar, P. G. Khubchandani, and V. M. Padmanabhan (Atomic Energy Establishment (Trombay), Bombay, India). THORIUM ORTHOPHOSPHATE, $Th_3(PO_4)_4$. Jagdish Shankar and P. G. Khubchandani

(Atomic Energy Establishment (Trombay), Bombay, India). Anal. Chem. 29, 1374-5(1957) Sept.

**12002**

LUMINESCENCE OF SODIUM FLUORIDE ACTIVATED BY URANIUM. Z. M. Sverdlov (All Union Research Inst. of Geology). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 21, 710 (1957) May. (In Russian)

A simple quantitative method for determination of U in ores and water has been developed utilizing the specific luminescence properties of NaF(U). Detailed account of the method is given in Optika i Spectroskopia 3, 3(1957). (R.V.J.)

**12003**

NONSTOICHIOMETRY AND LATTICE DEFECTS IN URANIUM HYDRIDE. George G. Libowitz (Tufts Univ., Medford, Mass.). J. Chem. Phys. 27, 514-18(1957) Aug.

Expressions were derived for the hydrogen pressure over nonstoichiometric metallic hydrides from statistical mechanical considerations. Two separate relations were obtained depending on whether lattice vacancies or interstitial atoms were taken to be the cause of hydrogen deficiency in hydrides. For the case of one-to-one binary hydrides, the two equations become identical. By comparing the pressure-temperature-composition data for uranium hydride with the derived equations, it was established that the nonstoichiometry of this compound was due to hydrogen vacancies in the lattice rather than interstitial uranium atoms. The energy necessary to form a hydrogen vacancy in uranium hydride was found to be 68.2 kcal/mole, while a value of 6.5 kcal/mole was determined for the interaction energy between vacancies. (auth)

**12004**

FLUORESCENCE AND ABSORPTION SPECTRA OF URANYL SALTS. D. D. Pant andB. C. Pandey (D.S.B. Government Coll., Naini Tal, India). J. Sci. Ind. Research (India) 16B, 280-5(1957) July.

The intensity reversal in fluorescence and absorption of two bands $A_0$ and $B_0$ in the spectra of four uranyl salts has been studied. The various interpretations for the violet companions of the $B_0$ bands have been discussed. It has been shown that the two bands are due to two close levels. (auth)

## WASTE DISPOSAL

**12005** AERE-C/R-2202

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

FIXATION OF ACTIVITY IN SOLID FORM BY ABSORPTION ON SOILS. Part 2. Final Report. A. B. Amphlett and D. T. Warren. Apr. 1957. 11p. (FPSD/P-22).

By incorporating radioactive solutions into mixtures of waste solutions and soil, glasses are formed on heating to temperatures of ~1000°C. Leaching tests show that these are highly resistant to water and would be suitable for disposal of highly-active wastes. Only Ru volatilizes appreciably during the firing process, and its loss may be kept to a minimum by suitable control of the process, as it is easily trapped, and could be returned to the process if required. The results of this work are compared with those of other studies on solid fixation. (auth)

**12006** CF-57-1-172

Oak Ridge National Lab., Tenn.

RADIOACTIVE WASTE DISPOSAL AND MISCELLANEOUS WORK. Annual Report for Calendar Year 1956. H. E. Seagren and E. J. Witkowski, comps. Sept. 11, 1957. 10p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80 (mf OTS).

An annual report is given on the operation and costs of waste-disposal facilities at ORNL laboratories and operating buildings in the Bethel Valley area. The operations of the hot-chemical and metal-waste systems, the process-waste system, and the radioactive-gas-disposal system which utilizes the 250-ft stack located in the Radioisotope area are discussed. The miscellaneous operations which include the SS (source and special nuclear) material control, SS material recovery, off-shift service for research divisions, water demineralization plant operations, and hydrogen liquefaction are included. However, the disposal of cooling water from LITR, off-gases from the Hot Pilot Plant, and the ORNL Graphite Reactor buildings are not covered by the report. (R.V.J.)

**12007** CF-57-3-114(Rev.) (Suppl. 1)

Oak Ridge National Lab., Tenn.

SECTION 9.0 TO STATUS REPORT ON THE DISPOSAL OF RADIOACTIVE WASTES. Floyd L. Culler, Jr., comp. and ed. Sept. 3, 1957. 47p. Contract [W-7405-eng-26]. $7.80(ph OTS); $3.30(mf OTS).

Chemical processes for fission product concentration, removal, or fixation are discussed. The concept of a multipurpose waste processing facility is reviewed. Waste treatment processes discussed in detail include evaporation, precipitation processes for fission product recovery from high level aqueous systems, fission product recovery by ion exchange, and fission product recovery by solvent extraction. 107 references. (C.H.)

# ENGINEERING

**12008** NACA-TM-1183

TEMPERATURES AND STRESSES ON HOLLOW BLADES FOR GAS TURBINES. Erich Pollmann. Translated by Mary L. Mahler from Deutsche Luftfahrtforschung, Forschungsbericht Nr. 1879. Sept. 1947. 108p.

Theoretical investigations and test-stand measurements which were carried out in developing the hollow blade for exhaust gas turbines are reported. As an introduction the temperature variation and the stress on a turbine blade for a gas temperature of 900°C and circumferential velocities of 300 meters per second are discussed. The assumptions on the heat transfer coefficients at the blade profile are supported by tests on an electrically heated blade model. The temperature distribution in the cross section of a blade is thoroughly investigated and the temperature field determined for a special case. A method for calculation of the thermal stresses in turbine blades for a given temperature distribution is indicated. The effect of the heat radiation on the blade temperature also is dealt with. Test-stand experiments on turbine blades are evaluated, particularly with respect to temperature distribution in the cross section; maximum and minimum temperature in the cross section are ascertained. Finally, the application of the hollow hollow blade for a stationary gas turbine is investigated. Starting from a setup for 550°C gas temperature the improvement of the thermal efficiency and the fuel consumption are considered as well as the increase of the useful power by use of high temperatures. The power required for blade cooling is taken into account. The possibility to apply high circumferential velocities with good efficiency is discussed. (auth)

**12009**

RADIOACTIVE CUTTING TOOL AND PISTON RING WEAR TESTS. A. J. Snow and H. L. Skonecke (Sinclair Research Labs., Harvey, Ill.). Atompraxis 3, 299-306(1957).

Radioisotopes are currently being used at Sinclair Re-

search in accelerated wear tests on cutting fluids and motor oils. Radioactive cutting tool tips are used to measure the effect of various cutting fluid formulations on cutting tool face and flank wear. The cutting tool tests are run on a standard milling machine with the radioactive tool completely enclosed in an adequately shielded cutting chamber. Cutting fluid test data are run on a comparative basis with the experimental fluid wear rate compared against that of a known reference fluid wear rate. Experimental arrangements, shielding, and sample data are given. Piston ring wear as a function of oil composition and or engine operating conditions is measured by use of a radioactive top compression ring on a single cylinder COT test engine. Engine oil is pumped from the crankcase through a cooler, counter, reheater, and back into the engine. Major initial problems in this test setup included stagnant oil in the counting chamber, variable oil flow rates through the external oil circulation system compotents, and dispersant characteristics of certain oils. Experimental arrangements and sample data are given. Both of these test techniques employ large sodium iodide crystals as gamma ray detectors. These scintillation detectors allow the use of lower activity radioisotopes than conventional geiger tube detectors and more rapid counting techniques. Safety procedures and routine daily operation of this test equipment with non-technical personnel are described. No difficulties have been encountered in keeping the radiation exposure of all personnel well below the authorized AEC levels. (auth)

**12010**

WATER CONDITIONS FOR HIGH PRESSURE BOILERS. D. E. Voyles (Duke Power Co., Charlotte, N. C.) and E. C. Fiss (Carolinas-Virginia Nuclear Power Associates, Charlotte, N. C.). Corrosion 13, 589t-90t(1957) Sept.

Components of a high-pressure boiler system which are in contact with high-purity water are described. Materials of construction and operating pressures and temperatures are given for such items as condensers, feedwater heaters and boiler components. Demineralized and evaporated make-up are referred to along with data on the chemical nature of the water. Analyses of water and steam samples from points in the boiler water cycle show iron and copper contents and other indications of the purity and corrosiveness of the water. The part played by chemical treatment, boiler blowdown, removal of dissolved gases and other operating factors in maintaining the described water conditions are discussed. (auth)

## HEAT TRANSFER AND FLUID FLOW

**12011** APEX-321

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.

TIME AND SPACE TEMPERATURE DISTRIBUTION IN A SPHERE WITH AN INTERMITTENT CONSTANT HEAT SOURCE. J. F. Heyda. Aug. 12, 1957. 15p. Contracts AF33(038)-21102 and AT(11-1)-171. $0.20(OTS).

A material sphere revolves in a circular orbit and passes through regions of heating and cooling, separated by regions of transition in which heat is neither generated nor removed. In the heating region a constant volumetric heat source is operative; in the cooling region heat is removed by flowing fluid. In order to compute the temperature and stress limits of the material comprising the sphere, it is necessary to know the time variation of the radial temperature profile of the sphere at any point in its orbit. The problem is reduced to the simultaneous solution of three integral equations for the time-dependent radial temperature profiles in the cooling region and in the two transition regions. All the physical parameters are left in general form so that computations may be made as desired. (auth)

**12012** IDO-28001

Aerojet General Corp., Azusa, Calif.

POLYPHENYL-COOLANT BURNOUT STUDIES. Monthly Progress Report No. 7 [for] May 16 through June 15, 1957. K. Sato. July 19, 1957. 12p. Contract AT(04-3)-44. (AGC-L2917-7). $3.30(ph OTS); $2.40(mf OTS).

(See also AGC-AE-23.)

**12013** SCL-T-138

CERTAIN FLAT-SURFACE (PLANE) PROBLEMS IN THE THEORY OF THERMIC WAVES. (Nekotorye Ploskiye Zadachi Teorii Teplovykh Voln). B. G. Korenev. Translated from Doklady Akad. Nauk S.S.S.R. 112, 29-32(1957). 11p.

The problems pertaining to thermic waves in thin plates (flat laminae), whose thickness h is sufficiently small are analyzed. The temperature is taken to be constant, according to the thickness. The following are also constant: the specific thermal capacity c, the density p, and the coefficient of heat conduction (conductivity) $\lambda$. The coordinate axes x and y are placed in the middle (intermediate) plane (surface). Two types of boundary conditions along the planes $z = \pm h/2$ are examined. In the first, both planes function as adiabatic boundaries. This case coincides with the "flat" problem of thermal waves in an unbounded cylinder. In the second type there occurs a heat exchange with the medium along both planes—an exchange describable by the boundary (limitary) conditions of the third order. In both cases, the thermal waves problem has many things in common with the problems regarding the bending of plates on a cushioned (elastic) base (support). (tr-auth)

**12014**

HYDROGEN–WATER VAPOR CONDENSERS DESIGN. S. Finzi, R. Renzoni, M. Silvestri, and R. Zavattarelli (CISE Labs., Milano). Energia nucleare (Milan) 4, 199-210(1957) June.

In certain plants for heavy water production, the problem of condensation of water vapor-hydrogen mixtures and the design of condensers are very interesting and economically important. No data for designing condensers for water vapor-hydrogen mixtures were in literature, and nothing leads to believe that the known Colburn-Hougen method can apply in this case. Thus the applicability of this method to these particular mixtures was studied. Many experiments, carried out by means of a vertical condenser in countercurrent with water, in a variation range of temperature from 30 to 80°C, at room pressure, were performed. The experimental results were compared with calculations made by using the Colburn-Hougen method in a slightly modified version and the possibility of designing condensers to a sufficient approximation was assured. (auth)

**12015**

MASS AND HEAT TRANSFER IN CONCURRENT LIQUID-GAS FLOW. POSSIBLE APPLICATION TO SOME SEPARATING PROCESSES AND TO SOME SEPARATING UNITS. S. Finzi, R. Renzoni, M. Silvestri, and S. Villani (CISE Labs., Milano). Energia nucleare (Milan) 4, 211-21(1957) June.

Isothermal mass transfer is studied in the case when liquid water is forced to raise by water vapor and experimental results are presented for the $FDO-H_2O$ system. In the case of non-isothermal heat and mass transfer, results are applied to the possible recovery of heat in separating units, based on the chemical exchange between hydrogen and water. (auth)

## MATERIALS TESTING

**12016** HW-48884

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

TECHNICAL INFORMATION FOR THE APPLICATION OF HYPALON RUBBER IN CHEMICAL SEPARATIONS PLANTS. J. H. Kleinpeter. Mar. 5, 1957. 9p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

Hypalon rubber is an ozone-resistant chlorosulfonated polyethylene elastomer. The outstanding resistance of this material to oxygen and oxidizing environments prompted its evaluation for possible use in chemical separations plants. Hypalon rubber was found to be resistant to 60% nitric acid and 50% sodium hydroxide at room temperature, but not suitable in boiling solutions of nitric acid of any concentration. Organic solvents cause a rapid swelling and severe damage to Hypalon, and exposure to air at temperatures of 100°C and over cause the material to harden. Hypalon was not seriously affected when exposed to $\gamma$ radiation below $10^8$ r. Exposure to $5 \times 10^7$ r $\gamma$ radiation seemed to improve its tolerance to solvents but decrease its room temperature resistance to 60% nitric acid. (C.H.)

**12017** HW-50131

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

TECHNICAL INFORMATION FOR THE APPLICATION OF FLUORORUBBER 1F4 (POLY-FBA) IN CHEMICAL SEPARATIONS PLANTS. J. H. Kleinpeter. May 7, 1957. 6p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80 (mf OTS).

Fluororubber 1F4, also known as Poly-FBA, is a polymer of 1,1-dihydroperfluorobutyl acrylate. The outstanding resistance of this material to organic solvents, including aromatics, ketones, and chlorinated hydrocarbons, prompted its evaluation for possible use in chemical separation plants. Fluororubber 1F4 was found to be resistant to 10% and 60% nitric acid, 50% sodium hydroxide, carbon tetrachloride, Recuplex CAX, Purex HAX, and distilled water at room temperature. Exposure to hexone caused a 25% increase in length and some softening. It will not tolerate boiling 60% nitric acid. Exposure in a $\gamma$ field had little effect on the chemical compatibility until the exposure reached $10^8$ r. A total exposure of $10^8$ r caused the samples to degrade quite severely on the surface when submerged in test solution. The rubber tends to cold flow and take a permanent set. It was concluded that these characteristics limit the field of useful application of this elastomer. (C.H.)

**12018** KAPL-M-WVJ-3

Knolls Atomic Power Lab., Schenectady, N. Y.

THE FRICTION AND WEAR OF STEELS IN HIGH TEMPERATURE WATER. W. V. Johnston, D. G. Groleau, and A. K. Eikum. June 6, 1957. 15p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

Results of friction and wear tests on steels in high temperature water are given. (W.L.H.)

**12019** NBS-3590

National Bureau of Standards. Cryogenic Engineering Lab., Boulder, Colo.

AN EXPERIMENTAL STUDY OF THE STRENGTH AND FATIGUE OF GLASS AT VERY LOW TEMPERATURES. Technical Memorandum No. 37. R. H. Kropschot and R. P. Mikesell. June 22, 1956. 13p. NBS Project 8100-00-8617. $3.30(ph OTS); $2.40(mf OTS).

The strength and fatigue properties of BSC-2 optical glass were measured at various temperatures within the range 20 to 296°K. Simple beam specimens with two point loading were tested in both the abraded and unabraded condition. The breaking stress, for a given condition, increases with decreasing temperature. The fatigue decreases with decreasing temperature but still exists at 76°K. (auth)

**12020** NP-6402

Syracuse Univ., N. Y. Research Inst.

MATERIALS EVALUATION IN RELATION TO COMPONENT BEHAVIOR. Proceedings of the Third Sagamore Ordnance Materials Research Conference on December 5, 6, and 7, 1956. 622p. Contract DA-30-115-ORD-667. (MET-365-574).

Twenty-one papers are presented on materials evaluation, analysis of failures, performance and testing of complex structures, stress corrosion and hydrogen embrittlement, and evaluation of weldments. The papers are entitled: The Evaluation of Steels; The Evaluation of Non-Ferrous Materials; Design Parameters for Cermets; Plasticity and Fracture; A Survey of the Low-Temperature Brittle Fracture Problem; Toughness of Ti Alloy Sheet; Notch-Tension Testing; Bucket Failure Mechanisms and Problems in Correlation of Lab Data with Gas-Turbine Bucket Performance; Material Properties and Their Use in Design; Prediction of Creep and Creep Buckling of Thin Symmetrical Shells from Tensile Creep Data; Application of Lab Data to Design of Aircraft Gas-Turbine Blade Fastening Models; Application of Lab Fatigue Data to Gear Design; Design Aspects of High-Speed Rotating Parts; Development and Testing of Mg Alloy Wheels; High-Temperature Properties in Relation to Design; Evaluation of Stress-Corrosion Effects; Studies of Hydrogen Embrittlement Produced by Electrolysis; Test Methods for Evaluation of Hydrogen Embrittlement; Tests for Evaluation of Weldments; V-Notch Charpy Impact Testing Welded Joints; Stress-Rupture Behavior of Weldments and Brazed Joints. (T.R.H.)

## PUMPS

**12021** HW-51773

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

DEVELOPMENT AND TESTING OF AN AIR-OPERATED PUMP FOR CONTINUOUS IN-LINE SAMPLING SYSTEMS. J. Dunn. June 27, 1957. 4p., 1 illus. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

Two air-operated pumps have been operated successfully for extended periods (one unit for over 9800 hours and the second or prototype unit for over 5550 hours) while pumping water, 2M $Al(NO_3)_3$ solution, and organic spray base in successive tests. Performance of the two units was unaffected by solution and temperatures from −29°C to 105°C. Both have delivered regulated quantities of the solutions with precision and reproducibility throughout the life tests. The pumps were initially designed to supply samples of liquids to in-line monitoring devices and have adequately fulfilled the requirements. Current development is being extended to adapt the design to fluid transfer service. (auth)

## VACUUM SYSTEMS

**12022** NBS-3535

National Bureau of Standards. NBS-AEC Cryogenic Engineering Lab., Boulder, Colo.

A LARGE VACUUM OVEN. Technical Memorandum No. 34. R. B. Jacobs, R. J. Richards, and S. B. Schwartz.

May 12, 1955. 27p. NBS Project 8101-20-2665. $4.80 (ph OTS); $2.70(mf OTS).

A design is offered of a vacuum oven with metallic parts which are outgassed before they are assembled. Descriptions are presented of the structural parts of the oven and the insulation, the heating system and controls, the pumping system and controls, and the vacuum and measuring system and controls. (R.V.J.)

### WASTE DISPOSAL

**12023** WAPD-PWR-PMF-414
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
PWR RADIOACTIVE WASTE DISPOSAL SYSTEM. J. R. LaPointe. Sept. 7, 1956. 6p. Contract AT-11-1-GEN-14. $1.80(ph OTS); $1.80(mf OTS).

## MINERALOGY, METALLURGY, AND CERAMICS

### CERAMICS AND REFRACTORIES

**12024** WADC-TR-55-491(Pt. II)
Illinois. Univ., Urbana.
RESEARCH ON ELEVATED TEMPERATURE RESISTANT CERAMIC STRUCTURAL ADHESIVES. Period covered: November 1955 to October 1956. Henry G. Lefort, Richard M. Spriggs, and Dwight G. Bennett. Dec. 1956. 74p. Project title: RUBBER, PLASTIC AND COMPOSITE MATERIALS. Task title: STRUCTURAL ADHESIVES. Contract AF33(616)-2556. (AD-110736; PB-121941).

The object of the investigation was to develop high temperature resistant structural adhesives for type 301 and 302 stainless steel or other desired alloy metals, particularly 17-7 PH, from ceramic-oxide, glassy-bonded coatings, cermets with sintered metal bonds, air-setting, temperature-resistant silicates, aluminates, oxychlorides, oxysulfides, and ceramic-oxide, resin-bonded coatings. Twenty-four ceramic adhesives of the ceramic-oxide, glassy bond type, including three commercially available porcelain enamel ceramic adhesives, were evaluated for use at room and elevated temperatures. Evaluation was based on shear strength tests using type 302 stainless steel. Several of these ceramic adhesives were used to bond small type 17-7 PH stainless steel honeycomb sandwiches. Type 17-7 PH stainless steel was evaluated for shear strength using ceramic adhesive UI 117-50. Various methods of specimen and ceramic adhesive preparation and fabrication were investigated for increase in shear strength including knurled overlap areas, mechanical scouring of overlap areas, chemical pickling and nickel plating of overlap areas, and the use of various foils and screens as carriers. Stainless steel screen of 325 mesh when used as a carrier gave an average shear strength of 1160 psi at 800°F. Copper screen of 60 mesh gave an average shear strength of 1180 psi at 800°F when used as a carrier. Porcelain enamel ceramic adhesives of thermal expansions approaching that of ingot iron shear specimens generally gave the highest shear strengths. Resorcinol-formaldehyde-Portland cement adhesives did not show great promise as adhesives, especially at elevated temperatures. Stress rupture determinations using ceramic adhesive UI 117-50 on type 302 stainless steel shear strength specimens yielded results of 700 psi for 171 hours with no failure, and 800 psi for 22 hours with failure at room temperature. At 600°F, the adhesive withstood 600 psi for 500 hours without failure. (auth)

**12025**
RADIATION EFFECTS ON CERAMICS. Am. Ceram. Soc. Bull. 36, 372-4(1957) Sept.

### CORROSION

**12026** HW-51267
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
THE EFFECT OF LOCALIZED CARBURIZATION ON THE CORROSION RESISTANCE OF STAINLESS STEEL PIPE AND TUBING. William L. Walker. July 8, 1957. 7p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80 (mf OTS).

Three small-diameter 304L stainless steel pipes which failed the Huey test were examined. It was found that the greater weight loss occurred inside the tube, and high corrosion rates were observed until the carburized layer was removed. This layer is said to have resulted from incomplete cleaning prior to heat treatment. (T.R.H.)

**12027** CF-56-10-14
Oak Ridge National Lab., Tenn.
HRP DYNAMIC SLURRY CORROSION STUDIES: QUARTER ENDING OCTOBER 31, 1956. E. L. Compere, H. C. Savage, S. A. Reed, G. E. Moore, R. M. Warner, S. R. Buxton, J. A. Russell, Jr., R. M. Pierce, and D. B. Weaver. Oct. 31, 1956. 81p. Contract [W-7405-eng-26]. $13.80(ph OTS); $4.80(mf OTS).

Dynamic corrosion data and operating observations for five $ThO_2$ slurry runs in 100A pump loops are reported. Studies are presented on the effects of $Na_4P_2O_7$ and $Na_2SiO_3$ as slurry additives, under $O_2$ or $H_2$ atmospheres, on corrosion by $ThO_2$ slurries circulating in toroids. (For preceding period see CF-56-7-51.) (T.R.H.)

**12028** TID-7006
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
CORROSION AND WEAR HANDBOOK FOR WATER COOLED REACTORS. D. J. DePaul, ed. Mar. 1957. 300p. $2.25(GPO).

An accumulation and correlation of corrosion and wear data acquired during the development of a water-cooled reactor for a submarine is presented. Background information is given on the fundamental aspects of iron corrosion, friction and wear, and on water technology. The testing procedures employed are described, and the methods of approaching general and localized corrosion problems are surveyed. The relative importance of the different variables involved in the corrosion studies reported is discussed. Special studies of crevice corrosion, stress corrosion, intergranular corrosion, corrosion products in recirculating systems, application considerations of wear, and manufacturing procedures affecting corrosion and wear are included. Extensive tabulations of data for many materials under many different conditions are presented. (T.R.H.)

**12029**
CORROSION PROBLEM IN ATOMIC REACTORS BY HIGH TEMPERATURE WATER. Willibald Machu. Atomkern Energie 2, 248-55(1957) July. (In German)

**12030**
CORROSION AND METAL TRANSPORT IN FUSED SODIUM HYDROXIDE. PART 1. EXPERIMENTAL PROCEDURES. G. Pedro Smith and E. E. Hoffman (Oak Ridge National Lab., Tenn.) and M. E. Steidlitz (International Business Machines Corp., Poughkeepsie, N. Y.). Corrosion 13, 561t-4t(1957) Sept.

Experimental techniques are described for studying corrosive reactions and metal transport in fused sodium hydroxide at temperatures up to 815°C. The apparatus described is designed for small-scale testing. Some of the factors which previous research has shown to be of importance in the design of fused hydroxide corrosion tests are reviewed. Test methods discussed include the capsule test technique, cold finger test technique, and controlled-atmosphere test technique. (auth)

**12031**

BIBLIOGRAPHIES OF CORROSION PRODUCTS. Corrosion 13, 565t-70t(1957) Sept.

Selected abstracts are given on the identification and composition of corrosion products on aluminum, lead and lead alloys, silver, tin and tin alloys, and magnesium. Included are 37 abstracts on aluminum; 19 on lead and lead alloys; 15 on silver; 26 on tin and tin alloys; and 21 on magnesium. (auth)

**12032**

MEASUREMENT OF CORROSION PRODUCTS IN HIGH TEMPERATURE, HIGH PRESSURE WATER SYSTEMS. A. A. Sugalski and S. L. Williams (Knolls Atomic Power Lab., Schenectady, N. Y.). Corrosion 13, 572t-4t(1957) Sept.

The concentration of corrosion products and other impurities which produce undesirable radionuclides must be maintained at extremely low values in the primary coolant systems of nuclear power plants to keep the resulting radioactive dose rate below certain maximum values. In the development of purification systems for maintenance of these low concentrations it is necessary to measure the concentration of the various impurities and their solubility as they exist at the primary coolant temperature. This paper describes the development of a high efficiency filter used for this purpose and gives data obtained from both radioactive and non-radioactive water systems. (auth)

**12033**

CORROSION OF ALUMINUM–NICKEL TYPE ALLOYS IN HIGH TEMPERATURE AQUEOUS SERVICE. F. H. Krenz (Atomic Energy of Canada, Ltd., Chalk River, Ontario). Corrosion 13, 575t-81t(1957) Sept.

Aluminum can be made resistant to high temperature water by small alloying additions of Ni, Fe, and Cu. In the presence of adequate concentrations of the cathodic second phase formed by these additions, the high temperature attack changes from grain boundary penetration and blistering to a more desirable uniform over-all attack. The latter causes two films to be formed on the corroding surface, Film A growing outward from the original surface and Film B growing inward into the metal. Film A reaches a limiting thickness after 2 to 3 weeks at 300 C, but Film B continues to grow linearly with time. At this stage the corrosion rate is acceptably low ($\sim 1 \times 10^{-3}$ inches/yr) but the corrosion film is 10 to 20 $\mu$ thick, relatively brittle and subject to severe mechanical damage in water flowing at high linear velocities. Reactor radiation has an insignificant effect upon corrosion. Heat fluxes of the order of 100 watts/cm$^2$ also appear to have little effect, though in this instance the effect may have been obscured by mechanical damage. Extensive test data are reported on the corrosion resistance in high-temperature water of three specially selected aluminum alloys. (auth)

**12034**

CORROSION OF ALUMINUM IN HIGH PURITY WATER. R. J. Lobsinger and J. M. Atwood (Hanford Atomic Products Operation, Richland, Wash.). Corrosion 13, 582t-4t (1957) Sept.

In-reactor corrosion rates of 1245 and M-388 aluminum alloys were determined in demineralized water at temperatures up to 200 C. A correlation between corrosion rates and the effective aluminum surface temperature is presented. The effect of increased hydrogen ion concentration on corrosion rates is also discussed. (auth)

**12035**

SYMPOSIUM ON HIGH-PURITY WATER CORROSION. Philadelphia, American Society for Testing Materials, 1956. 61p. $1.75.

The following reports were presented at the Symposium on High-Purity Water Corrosion: The Preparation and Maintenance of High-Purity Water, The Use of Water in Atomic Reactors, Influence of Water Composition on Corrosion in High-Temperature High-Purity Water, Effect of Material Composition in High-Temperature Water Corrosion, and Special Corrosion Study of Carbon and Low Alloy Steels. (J.E.D.)

## GEOLOGY AND MINERALOGY

**12036** NYO-3750

Pennsylvania State Univ., University Park. Mineral Industries Experiment Station.

DIELECTRIC CONSTANTS OF ROCKS AND MINERALS. Final Progress Report. B. F. Howell, Jr. and P. Licastro. July 8, 1957. 15p. Project C-15. Contract AT(30-1)-1345. $3.30(ph OTS); $2.40(mf OTS).

A method of measuring the dielectric constants of mineral specimens in the frequency range 50 cps to 30 megacycles using two null-bridge systems, one for low and one for high frequencies, is described. Values of the dielectric constant of 63 rock and mineral specimens are tabulated. Dry rocks and some minerals studied either showed no variation in dielectric constant with frequency, or had a slight decrease with frequency. Wet specimens, and other minerals varied greatly in dielectric constant, the dielectric constant falling in most cases asymtotically to a fixed value at high frequencies according to the formula $K = K_0 + AF^{-\alpha}$. (auth)

**12037** NYO-6634

Carnegie Inst. of Tech., Pittsburgh.

COSMIC-RAY-INDUCED RADIOACTIVITIES IN METEORITES AND TEKTITES (thesis). William D. Ehmann. June 3, 1957. 134p. Contract AT(30-1)-844.

**12038**

SOVIETS PROSPECT FOR SATELLITE URANIUM. Serge L. Levitsky. Atombrief 3, No. 8, 14-16(1957) Aug. (In German)

**12039**

OCCURRENCE OF URANIUM IN ITALY. P. Baggio, F. Ippolito, S. Lorenzoni, G. Marinelli, and F. Silvestro. Energia nucleare (Milan) 4, 196-8(1957) June.

**12040**

PRELIMINARY GEOLOGIC MAP OF THE SENTINEL PEAK NW QUADRANGLE, MONTEZUMA COUNTY, COLORADO. MINERAL INVESTIGATIONS FIELD STUDIED MAP MF 132. E. B. Ekren and F. N. Houser. Washington, U. S. Geological Survey, 1957. $0.50.

**12041**

PRELIMINARY GEOLOGIC MAP OF THE LAGUNA 4 NW QUADRANGLE, BERNALILLO, SANDOVAL, AND VALENCIA COUNTIES, NEW MEXICO. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 133. R. H. Moench and W. P. Puffett. Washington, U. S. Geological Survey, 1957. $0.50.

**12042**

PRELIMINARY GEOLOGIC MAP OF THE LAGUNA 4 SW QUADRANGLE, BERNALILLO AND VALENCIA COUNTIES, NEW MEXICO. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 134. R. H. Moench and W. P. Puffett. Washington, U. S. Geological Survey, 1957. $0.50.

**12043**

PHOTOGEOLOGIC MAP OF THE BUCKSKIN GULCH SW QUADRANGLE, KANE COUNTY, UTAH, AND COCONINO COUNTY, ARIZONA. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-244. R. J. Hackman. Washington, U. S. Geological Survey, 1957. $0.50.

**12044**

PHOTOGEOLOGIC MAP OF THE JOHNSON NE QUADRANGLE, KANE COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-245. R. J. Hackman. Washington, U. S. Geological Survey, 1957. $0.50.

**12045**

GEOLOGY OF THE WOOD AND EAST CALHOUN MINES, CENTRAL CITY DISTRICT, GILPIN COUNTY, COLORADO. Avery A. Drake, Jr. U. S. Geol. Survey Bull. 1032-C. 46p and 4 drawings. Available from U. S. Government Printing Office for $1.00.

The Wood-East Calhoun area is underlain by complexly folded Precambrian gneiss and pegmatite. The major fold is an anticline that trends about N. 60° E. The Precambrian rocks are intruded by bostonite porphyry dikes of Tertiary age. All the rocks are cut by eastward- to northeastward-trending faults that have been filled by precious-metal-sulfide veins which have been worked chiefly for gold. The Wood vein, which has produced much of the U of the Central City district, fills an east-trending fault; the Calhoun vein is in a northeast-trending fault. The veins consist chiefly of quartz; pyrite is the predominant metallic mineral and chalcopyrite ranks next in abundance. Sphalerite, galena, tetrahedrite-tennantite, and pitchblende occur locally. Alteration-stage quartz and pyrite were deposited first, followed in order of deposition by pitchblende, light-yellow pyrite, massive quartz, yellow pyrite, sphalerite, comb quartz, chalcopyrite, tetrahedrite-tennantite, galena, chalcopyrite, pyrite, and gray to light-brown fine-grained quartz. The veins of the district are zoned; quartz-pyrite veins are near the center, and galena-sphalerite veins are on the periphery. The pitchblende bodies occur between these veins, but, paragenetically, the pitchblende is earlier than all other metallic minerals. A trace-element study of the ore shows an association of Bi, Sb, and As with Cu, and of Cd with Zn; high-grade U samples contain unusually large quantities of Zr and Mo. Pitchblende and other ore minerals are concentrated in ore shoots. These are in open spaces controlled by the competency of the wall rocks, the presence of a prevailing direction of weakness in the rocks, and changes in strike and dip of the vein. The pitchblende is believed to be a local constituent of the quartz-pyrite ores and was deposited by residual solutions from the quartz bostonite magma. (auth)

**12046**

PROSPECTING FOR URANIUM. Washington, U. S. Atomic Energy Commission and U. S. Geological Survey, revised Jan. 1957. 232p. Available from U. S. Government Printing Office for $0.75.

This handbook on U prospecting includes U-bearing minerals, U occurrence and testing, use of radiation detection instruments, evaluation of discoveries, sale of U, and laws and regulations for prospecting. (J.E.D.)

## METALS AND METALLURGY

**12047** AERE-M/M-97

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE PREPARATION OF NIOBIUM METAL BY THE OXIDE REDUCTION ROUTE. N. R. Williams, J. H. Buddery, and J. D. Reeve. May 26, 1955. Decl. July 19, 1957. 23p.

The preparation of Nb metal by the Ca reduction of the oxide $Nb_2O_5$ and of a lower oxide approximating to $NbO_{1.4}$ is described. Calcium reduction of $Nb_2O_5$ was found to be unsatisfactory, and the greater part of the memorandum describes the route via the lower oxide. $NbO_{1.4}$ was most conveniently prepared by Na reduction of the important intermediate $K_2NbOF_5$. Calcium reduction of $NbO_{1.4}$ proceeded smoothly to yield a Nb powder of 98% purity, which could be rendered soft and ductile by vacuum treatment at 2200°C. The further consolidation of this pure metal is also described. (auth)

**12048** HW-47100

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

STATISTICAL ANALYSIS OF THE EFFECTS OF TEMPERATURE AND METAL GROUPS ON ULTIMATE STRENGTH, YIELD STRENGTH, AND ELONGATION. P. E. Leaverton and J. L. Jaech. Dec. 10, 1956. 3p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

**12049** IGR-TN/C-569

Gt. Brit. Culcheth Labs., Culcheth, Lancs, England.

THE MODES OF DEFORMATION LEADING TO FRACTURE OF METALS: A REVIEW OF PROGRESS TO JANUARY 1957. R. Doldon. July 1957. 10p.

Specimens of super-purity Al have been deformed in tension at room temperature and the surface topography subsequently examined. The features of the surface are discussed in relation to the early stages of deformation. At present the number of observations is insufficient to allow prediction of the deformation modes which ultimately lead to fracture. (auth)

**12050** IGR-TN/S-578

Gt. Brit. Dept. of Atomic Energy. Industrial Group, H. Q., Risley, Lancs, England.

A CODE OF PRACTICE FOR THE HANDLING OF ZIRCONIUM AND ITS ALLOYS. F. B. Holt and S. G. Wilson. July 1957. 12p.

A suggested code of practice for the handling of Zr and its alloys is presented. Descriptions of some of the recent experience of the A.E.C. indicating the necessity of extra care in handling this metal are given, and general consideration is given to plant and laboratory operating and accounting procedures. Suggested transport, storage and disposal methods are described and details of an installation provided for the safe disposal of large quantities of Zr swarf are given. (auth)

**12051** KAPL-M-TFF-1

Knolls Atomic Power Lab., Schenectady, N. Y.

A COMPARISON OF CATHODIC DISCHARGE AND CHEMICAL ETCHING AND THE USE OF REPLICATION TECHNIQUES FOR METALLOGRAPHIC SAMPLES. T. E. Fisher. June 21, 1957. 13p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

Comparison studies have been made on the use of cathodic discharge and chemical etchants for the preparation of metallographic samples. In addition, replicas of metallographic sample surfaces were prepared by two different techniques. The results of this study indicated

that cathodic discharge can be used as an additional tool for the examination of the microstructure of metals. The replication techniques tried indicate that it may serve as an efficient method for examining radioactive metallographic specimens without the concurrent radiation hazards normally encountered. (auth)

**12052** NBS-5009

National Bureau of Standards. Cryogenic Engineering Lab., Boulder, Colo.

MECHANICAL PROPERTIES OF THE AUSTENITIC STAINLESS STEELS AT LOW TEMPERATURES. Technical Memorandum No. 39. R. H.Kropschot and W. F. Graham. Aug. 30, 1956. 40p. NBS Project 8130-11-8131. $6.30 (ph OTS); $3.00(mf OTS).

Some recent measurements on the mechanical properties of the austenitic stainless steels down to 20°K are presented. In addition, data compiled from various sources are included. The properties included are chemical composition, tensile strength, yield strength, elongation, reduction of area, Young's modulus, impact strength, weld properties, effect of sensitization and sigma formation, and hardness after various amounts of cold work. (auth)

**12053** NP-6393

Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.

COMPILATION OF AVAILABLE INFORMATION ON Ti–5Al–2.5Sn ALLOY. H. A. Robinson. July 15, 1957. 110p.

The Ti–5Al–2.5Sn alloy is finding increased use in aircraft design, principally because it has a good combination of strength and weldability. The alloy has greater strength than unalloyed titanium and has approximately equivalent weldability. These properties make the Ti–5Al–2.5Sn alloy a very useful material, despite the fact that its formability as sheet is poorer than that of unalloyed titanium. In the preparation of this report, a large amount of information was examined. No attempt has been made to present all the available data. However, data given are believed to be representative of commercial production. In some instances, only one set of data for a particular property exist; these values are included rather than omit the information entirely. 82 references. (auth)

**12054** NP-6403

Battelle Memorial Inst., Titanium Metallurgical Lab., Columbus, Ohio.

THE DAMPING CAPACITY OF TITANIUM AND TITANIUM ALLOYS. R. E. Maringer. July 23, 1957. 19p.

There are too few data known to evaluate effectively the damping characteristics of Ti and Ti alloys. However, some generalities can be stated: the damping of Ti and Ti alloys appears to be, at room temperature, comparable to many other structural metals; the damping is stress dependent, increasing as the stress increases; the damping is temperature dependent, in general increasing with increasing temperature, but exhibiting discontinuities which may be associated with the phase transformation and/or the presence of impurities; the damping is structure sensitive, differing appreciably in the cold-worked, annealed, and quenched states; and the damping is sensitive to, in particular, the presence of oxygen and hydrogen, although the mechanism of energy dissipation is not known. (auth)

**12055** ORNL-2344

Oak Ridge National Lab., Tenn.

PHASE DIAGRAM STUDIES OF ZIRCONIUM WITH SILVER, INDIUM, AND ANTIMONY. J. O. Betterton, Jr., J. H. Frye, Jr., and D. S. Easton. Aug. 28, 1957. 54p. Contract W-7405-eng-26. $1.50(OTS).

The zirconium-rich portions of the Ag–Zr, In–Zr, and Sb–Zr phase diagrams were determined. The variation of the phase boundaries arising from the allotropic transition in Zr and Ti, in these systems as well as others in the literature, can be reduced to an approximate common behavior in terms of electron concentration if a metallic valency of two is used for Zr and Ti, and if allowance is made for energy effects due to unequal sizes of atoms. Thermodynamic relations are given for these phase boundaries which with certain approximations permit the boundaries to be used to deduce relative changes of energy in the two phases with alloy composition. (auth)

**12056** TML-73

Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.

THE PHYSICAL PROPERTIES OF TITANIUM AND TITANIUM ALLOYS. W. J. Lepkowski and J. W. Holladay. July 25, 1957. 86p. Contract AF18(600)-1375.

Information in the literature on the physical properties of Ti and Ti alloys is summarized. In some cases, an evaluation of the published results was made so that the most accurate value for the properties could be indicated. In other instances, insufficient background information accompanied the original data to permit an evaluation. The latter was the usual case when information on commercial alloys was presented. (auth)

**12057** WAPD-BT-2

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

THE BETTIS TECHNICAL REVIEW. VOLUME I, NO. 2. REACTOR METALLURGY. July 1957. 138p. Contract AT-11-1-GEN-14 and appropriate NObs Contracts. $1.00(OTS).

The Westinghouse physical metallurgy and nondestructive inspection programs are summarized. Discussions of and experimental results from studies of metal wear and friction in water, Zircaloy corrosion characteristics, order theory in $AB_2$ alloys, radiographic inspection, and eddy current testing are presented. (D.E.B.)

**12058** WAPD-PWR-CP-2433

[Westinghouse Electric Corp. Bettis Plant, Pittsburgh.] HIGH STRENGTH MATERIALS PROGRAM FOR PRESSURIZED WATER IN-PILE TUBES. S. A. Weber. Sept. 13, 1956. 18p. $3.30(ph OTS); $2.40(mf OTS).

The research program to find a high-strength material which will serve as a pressure tube material for the NRX Reactor and for the ETR is presented. The mechanical properties and corrosion tendencies of AISI types 410, 414, and 431, Croloy 16-1, AM-350, and Inconel X are summarized. (T.R.H.)

**12059** Y-1137A

Union Carbide Nuclear Co. Y-12 Plant, Oak Ridge, Tenn.

FINAL REPORT OF EXPLOSION IN OAK RIDGE, TENNESSEE, Y-12 SALVAGE YARD ADJACENT TO BUILDING 9929-1. July 20, 1956. Changed from OFFICIAL USE ONLY June 24, 1957. 38p. Contract W-7405-eng-26. $6.30(ph OTS); $3.00(mf OTS).

The explosion which occurred during the handling of scrap Zr at Y-12, May, 1956, is described. It was concluded by the Investigating Committee that the explosion was caused by finely-divided Zr metal. Maximum explosion pressure and temperature for $Zr-H_2O$ mixtures were calculated. Recommendations for the storage and handling of Zr are presented. (C.W.H.)

**12060** AEC-tr-3006

TRANSITION FROM BETA INTO OMEGA AND ALPHA IN TITANIUM ALLOYS. Horst Böhm and Herbert Westphal. Translated by M. F. Hoare from Z. Metallk. 47, 558-63 (1956). 6p.

Kinetics of the $\beta$ and $\omega$ or $\alpha$ transition-aging experiments on the alloys Ti–7% Mn, a complex Ti–Mn alloy, and

Ti–5% Cr–3% Al are presented. Dilatometric studies and TTT diagrams of the alloys are given. (W.L.H.)

**12061** AEC-tr-3012

ENERGY CONSUMPTION FOR ELECTROLYTE PROCESSES. Hermann Walde. Translated from Chem. Tech. (Berlin), 16, 153-7(1943). 18p.

The energy consumption is given for electrolytic processing of Al, Mn, Zn, Cu, Na, O, H, hydrogen peroxide, caustic alkalies, and chlorine products. The electrolytic installations and operational procedures are analyzed to determine a more economical consumption of electric energy. (R.V.J.)

**12062** AEC-tr-3020

ON THE DIFFUSIONAL MOBILITY OF ATOMS DURING THE MELTING AND RECRYSTALLIZATION OF METALS. P. L. Gruzin and A. D. Tyutynnik. Translated by S. Rothman from Fiz. Metal. i Metalloved. 3, 70-5(1956). 8p.

Data on self-diffusion indicated that the melting and recrystallization processes of different metals are determined by the levels of diffusional mobility. The threshold levels of diffusion mobility are determined by coefficients of the order of magnitude $10^{-22}$ $cm^2$/sec for recrystallization and $10^{-8}$ $cm^2$/sec for the melting of pure metals. The recrystallization of solid solutions occurred at much higher threshold levels (roughly at $10^{-13}$ $cm^2$/sec). (R.V.J.)

**12063**

NIOBIUM AS A NUCLEAR METAL. M. J. Cotter. Atomics 8, 339-42(1957) Sept.

Discussions on the sources, discovery, separation, preparation of metal, chemistry, metallurgical aspects, nuclear importance, fabrication, and compatibility with U are given. (M.H.R.)

**12064**

AN INVESTIGATION OF THE ZIRCONIUM–TANTALUM SYSTEM. V. S. Emelyanov, Yu. G. Godin, and A. I. Evstyukhin. J. Nuclear Energy 5, 247-52(1957).

Metallography, x-ray diffraction, thermal analysis, electrical resistance, and hardness measurements were employed in the study of the Zr–Ta system and the determination of its phase diagram. The diagram is a eutectic type and shows limited solubility in the solid state. The maximum solubility of Ta in $\alpha$-Zr at 790°C is less than 0.22 at. % while $\beta$-Zr will dissolve 16 at. % of Ta at 1585°C. Maximum solubility of Zr in Ta is 17 at. % at 1585°C. The eutectic occurs at 1585°C and 34 at. % Ta. A eutectoidal transformation of the solid solution based on $\beta$-Zr takes place at 790°C; the eutectoidal composition is 7 at. % Ta. (auth)

**12065**

INTERNAL STRESS FORMATION IN ALUMINUM ALLOYS AND PURE ALUMINUM. E. Macherauch and P. Muller. Naturwissenschaften 44, 389-90(1957). (In German)

**12066**

WELDING PROBLEMS IN PRESSURE VESSELS FOR NUCLEAR REACTORS. R. E. Lorentz, Jr. (Combustion Engineering, Inc., Chattanooga, Tenn.). Welding J. (N. Y.) 36, 881-7(1957) Sept.

Information and data are presented applicable to the fabrication of nuclear reactor components, outlining the need for the most rigid quality control available to the present technology. (auth)

**12067**

STRESS CORROSION OF TITANIUM WELDMENTS. Russell Meredith (North American Aviation, Inc., Downey, Calif.) and W. L. Arter (Air Reduction, Pacific). Welding J. (N. Y.) 36, 415s-18s(1957) Sept.

Investigation indicates that chlorinated hydrocarbon solution causes the development of stress-corrosion cracks when placed in contact with welded RC A110 AT titanium alloys at 700°F. (auth)

# PHYSICS

**12068** NP-6400

Naval Research Lab., Washington, D. C.

NRL QUARTERLY ON NUCLEAR SCIENCE AND TECHNOLOGY. Progress Report for the Period April–June 1957. July 1, 1957. 24p.

Additional results from studies of Coulomb excitation of Ba and Cs are reported. Two modifications of the Weyl form of the free-particle Dirac equations were developed from considerations of the group-space of the proper Lorentz group. An investigation of the energy saturation of nuclear matter is presented, based on the Brueckner many-body theory. Two variations of the Brueckner approach are made in the choice of a velocity-dependent potential and the use of phase shifts rather than tangents of phase shifts. The characteristics of 400 $K^-$-meson stars are tabulated. Additional $\Sigma$ hyperon lifetime data are given, and the kinematics of $\Sigma$ decay are discussed. Measurement of $\gamma$-ray angular distribution from Cr, Fe, Mg, and P from inelastic scattering of 2.45-Mev neutrons was initiated. The measurements are discussed and the apparatus is shown. A high-speed scaler with continuous automatic print-out was developed. Its circuitry is given. A brief evaluation is given of the potentials of an electron guide-field accelerator. A series of experiments was performed to examine the transformation behavior of iron oxides and hydrated oxides which constitute Fe–$H_2O$ corrosion products. (For preceding period see NP-6283.) (D.E.B.)

**12069** NRL-4887

Naval Research Lab., Washington, D. C.

ELECTRON SPIN RESONANCE IN CARBONS. L. M. Matarrese, L. S. Singer, and R. E. Vander Vennen. Jan. 11, 1957. 24p.

A preliminary investigation was made of electron spin resonance (ESR) absorption in sucrose and other materials charred between 300 and 700°C. The most important factors in determining the nature of the resonance absorption were found to be the temperature of carbonization and exposure of the samples to $O_2$. Radiofrequency saturation effects were observed in samples prepared below 500°C. Samples charred above 500°C gave an intense, narrow absorption line provided they had not been exposed to air, but in air the line was broadened considerably. Carbons containing adsorbed manganese (II) showed both the resonance of the carbon and the hyperfine structure of the manganese ESR spectrum. A comprehensive survey of the literature on ESR in carbons is given, and the nature of the resonance is discussed in the light of present knowledge of the structure of carbons. (auth)

**12070** OSR-TN-57-313

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

THE RESPONSE OF CRYSTAL PHOSPHORS TO NUCLEAR RADIATION. Technical Note No. 1. L. Reiffel. June 4, 1957. 56p. Project A-099. Contract AF-49(638)-113. (AD-132384).

The effect of pressure on luminescent systems is examined with particular reference to the phosphorescent decay of long-lived traps in thallium-activated NaI. It is shown that important parameters of the trapping centers

may be obtained by subjecting the phosphor to hydrostatic stress during phosphorescent decay. Increased pressure tends to favor configurational coordinate distances smaller than equilibrium values, while thermoluminescence experiments and other techniques resting on variations in temperatures carry the system with essentially equal probability to larger and smaller than equilibrium values of configurational coordinates. It is thus clear that pressure experiments can remove ambiguities of interpretation when the effects observed are related to spacial assymmetries of the center. From data obtained and a classical theory constructed for the effects, it is found that the critical displacement of $I^-$ ions from their equilibrium position which allows thermal collapse of a specific trap in NaI(Tl) is +0.19 angstroms (an outward displacement). For another trap in the same material it is found that thermal collapse sets in with the ions moved inward by −0.046 angstroms. The effect of these displacement values is observed as a change in phosphorescent lifetime under pressure. These results must be accounted for by any detailed calculation of the configurational coordinate curves for the center which starts from first principles. As a second illustration of the utility of pressure, a new type of experiment termed the "pressure break" has been devised. This is essentially equivalent to experiments where the temperature of the phosphor is changed over large ranges almost instantaneously. The ability of the phosphor to stand rapid pressure changes allows many interesting experiments to be done at essentially constant light sum in the crystal. The technique is still in early stages of development. (auth)

**12071** SCTM-183-57(14)

Sandia Corp., Albuquerque, N. Mex.

EVALUATION ON TEMPERATURE CHARACTERISTICS OF PIEZO COEFFICIENTS OF SAMPLES OF GENERAL ELECTRIC LEAD METANIOBATE AND A 56-MOL PER CENT LEAD ZIRCONATE-44-MOL PER CENT LEAD TITANATE COMPOSITION. Charles A. Sullivan. Aug. 7, 1957. 8p. Contract AT(29-1)-789. $1.80(ph OTS); $1.80(mf OTS).

Piezoelectric coefficient characteristics are given for General Electric lead metaniobate and a Clevite Research Center composition of lead zirconate-lead titanate known as PZT. Graphs are included which show the characteristic curves of each composition and the effects upon the element capacitance over their respective temperature ranges. (auth)

**12072** AEC-tr-3001

THE MEASUREMENT OF SMALL VAPOUR PRESSURES. Guilo Milazzo. Translated by E. L. Poole from Chem. Ing. Tech. 28, 646-54(1956). 26p.

**12073**

DIFFUSION OF THALLIUM (ThC″) IONS IN AIR. D. L. Baulch, J. F. Duncan, and J. P. Ryan (Univ. of Melbourne). Australian J. Chem. 10, 203-6(1957) May.

The diffusion coefficient of ThC″ was redetermined by measuring the yield of recoil atoms obtained at different gas pressures on a collector at a fixed distance from a source plate containing an equilibrium mixture of ThB, ThC, ThC′, and ThC″. (M.H.R.)

**12074**

THE INVARIANCE OF THE MEASUREMENT OF NEUTRINO FIELDS. Tzou Juo-Hsien. Compt. rend. 245, 502-5(1957) July 29. (In French)

The possibility of an invariance of measurement is studied in the four component theory as well as in the two component theory of the neutrino whose mass is rigorously conjectured as zero. (tr-auth)

**12075**

SCF LCAO MO STUDY OF $Li_2$. James E. Faulkner (Univ. of California, Livermore). J. Chem. Phys. 27, 369-73 (1957) Aug.

An LCAO molecular orbital calculation using the full six-electron Hamiltonian has been performed on $Li_2$ at a nuclear separation equal to the experimental internuclear distance. The molecular wave function consisted of one antisymmetrized product made up of molecular orbitals formed as the best linear combinations of Slater 1s, 2s, and $2p_\sigma$ atomic orbitals. The orbital exponents for these atomic orbitals were respectively 2.69, 0.64, and 0.53 as determined by a variational calculation on the lithium atom. In computing the molecular dissociation energy, the energy of two separated lithium atoms was taken to be that obtained by this variational calculation. The computed dissociation energy was found to be 0.33 ev compared with the experimental value of 1.05 (where a slight correction for zero-point energy has been made). The ratio of the computed molecular ground-state energy to the experimental is 0.9902 while the difference of these quantities is 4.00 ev. Certain other molecular constants are calculated and compared with available experimental data. (auth)

**12076**

MAGNETIC SUSCEPTIBILITY OF $NpF_6$. Bernard Weinstock and John G. Malm (Argonne National Lab., Lemont, Ill.). J. Chem. Phys. 27, 594-5(1957) Aug.

**12077**

RELATIVE MEASUREMENTS OF THE MEAN NUMBER OF NEUTRONS EMITTED PER FISSION INDUCED IN $^{233}U$, $^{235}U$, AND $^{239}Pu$ BY THERMAL NEUTRONS AND "FISSION" NEUTRONS. V. I. Kalashnikova, V. I. Lebedev, and P. E. Spivak. J. Nuclear Energy 5, 226-9(1957).

Ratios have been measured of the values of $\nu$ for fission induced in $U^{233}$, $U^{235}$, and $Pu^{239}$ by thermal and "fission" neutrons. The method was to count the number of coincidences between fission fragments and fission neutrons simultaneously with the total number of fissions. For all three nuclides, $\nu$ increases by approximately 10% in passing from the lower energy spectrum to the higher. (auth)

**12078**

FISSION OF HEAVY NUCLEI BY HIGH-ENERGY PARTICLES. A. K. Lavrukhina and L. D. Krasavina. J. Nuclear Energy 5, 236-46(1957).

The results of radiochemical investigations of the fission of U, Th, and Bi nuclei by 480-Mev protons have been analyzed. An interpolation method was used to obtain a full description of the fission products. It was observed that there was a predominant formation (58 to 64%) of isotopes having a neutron excess, and it is shown that isotopes of maximum yield are essentially among these nuclei. Symmetrical fission is most probable in the case of Bi. For U and Th the fission cross section is 55% and 60%, respectively, of the geometrical cross section, for Bi it is 5%. The charge distribution of the fission fragments produced by high-energy protons is independent of the mass number of the fission fragments and the atomic number of the fissioning nuclei. The results support a mixed barrier-emissive mechanism for the fission of U and Th nuclei. (auth)

**12079**

PROPULSION SYSTEMS EVALUATION. George P. Sutton. Missiles and Rockets 2, No. 9, 123-4, 126(1957) Sept.

Chemical, nuclear, solar, arc, and ion propulsion systems are compared as to specific impulse, thrust-to-weight ratio, range, and special characteristics. (T.R.H.)

**12080**

NON-METALLICS FOR MISSILES. NON-METALLICS TAKE OVER WHERE METALS LEAVE OFF. John H. Lux and Robert L. Noland. Missiles and Rockets 2, No. 9, 137-8, 141-2, 144(1957) Sept.

The fabrication of various shapes and forms of Rocketon and Missileon is described. Blast tubes, nose cones, jet vanes, nozzles, and insulation are fabricated from these materials by extrusion, spinning, indenting, casting, pressure molding, transfilling, hand lay-up, bag molding, and filament winding. (T.R.H.)

**12081**

ON THE AZIMUTHAL DISTRIBUTION OF K PHOTOELECTRONS BY POLARIZED PHOTONS. D. Brini, L. Peli, O. Rimondi, and P. Veronesi. Nuovo cimento (10) 6, 98-110(1957) July.

The angular distribution of K photoelectrons has been investigated in Pb using polarized Compton scattered photons of a $Co^{60}$ source. The selection of the events has been made by associating the photoelectrons to the correspondent fluorescence x ray. The measurement was performed by determining the behavior of the asymmetry ratio versus energy; the asymmetry ratio is the number of electrons emitted perpendicularly to the Compton scattering plane divided by the number of those emitted in the scattering plane. The results obtained do not seem to agree with Sauter's theory, but rather with Archibald's calculations. (auth)

**12082**

ON A MACROSCOPIC MEASUREMENT OF THE SPIN OF ELECTROMAGNETIC RADIATION. G. Toraldo di Francia. Nuovo cimento (10) 6, 150-67(1957) July.

The spin of electromagnetic radiation can be revealed at microwave frequencies by the torque exerted by a circularly polarized wave upon a screen which can conduct current only parallel to a given direction. In order to make an accurate quantitative measurement, one has to know the angular momentum cross section of the screen. The first few terms of a series expansion of the cross section are evaluated, with the assumption that the screen is a circular disc whose radius is small with respect to the wavelength. In order to assess the accuracy with which the polarization must be circular, also the imaginary part of the cross section is evaluated. Explicit expressions are given for the scattered field over the screen. The feasibility of the experiment is discussed. (auth)

**12083**

EVALUATION OF NUCLEAR FUSION PROBABILITY IN MESIC MOLECULES. S. Gallone, G. M. Prosperi, and A. Scotti. Nuovo cimento (10) 6, 168-72(1957) July.

The binding energies of the mesic hydrogen-like molecular ions have been calculated, together with the probability of nuclear fusion in the molecular ground state. (auth)

**12084**

ELECTRONIC STATES OF DIATOMIC MOLECULES: THE LITHIUM MOLECULE. R. Fieschi. Nuovo cimento (10) 6, 197-203(1957) July.

The electronic energy levels of $Li_2$ are calculated. The molecule is treated as a two-electron system; only configurations involving $2s\sigma$, $2p\sigma$, and $2p\pi$ molecular orbitals are considered. The results for the $^1\Sigma_u^+ - ^1\Sigma_g^+$ transition are in reasonable agreement with the experimental results; this is not the case for the $^1\Pi_u - ^1\Sigma_g^+$ interaction, probably owing to the inaccurate value of the core interaction in the two-electron molecular model. The purely theoretical LCAO MO results obtained taking into account configuration interaction are in disagreement with the experimental results in both cases. Although no decisive conclusion regarding the accuracy of the method can be drawn, since inclusion of 1s electrons will possibly influence the energy spacings, one does not find the disappointing results obtained by others in a similar calculation. (auth)

**12085**

ON THE CONSERVATION OF THE LEPTON CHARGE. W. Pauli (Swiss Federal Inst. of Tech., Zürich). Nuovo cimento (10) 6, 204-15(1957) July.

The independence of the conservation law for light particles (lepton charge) on other invariance properties of the theory of weak interactions, including the two component theory of the neutrino, is shown. Using invariance properties of S-matrix elements with respect to canonical transformations which leave initial and final state unchanged, those expressions of the second degree in the coupling constants are found, which in the matrix elements for double processes of negaton emission which would violate the conservation law, can alone occur. The two component neutrino theory is a special case. (auth)

**12086**

MAGNETIC HYDRODYNAMICS. S. I. Syrovatskiĭ. Uspekhi Fiz. Nauk 62, 247-303(1957) July. (In Russian)

Investigations of plasma behavior in magnetic fields are applied in modeling the cosmic electromagnetic processes and in studying the magnetohydrodynamic processes under laboratory conditions. The basic equations, the propagation of small perturbations, and the impact waves are analyzed on the basis of the new method. Some solutions are presented for the magnetic hydrodynamic equations. The amplification of the magnetic field and the hydromagnetic dynamo as well as the problems of stability and magnetodynamic turbulence are reviewed. 145 references. (R.V.J.)

**12087**

SELECTED LIST OF NEUTRON AND GAMMA IRRADIATION FACILITIES IN OPERATION, BEING BUILT, OR PLANNED. John H. Martens and F. G. Minuth, compss. Washington, U. S. Atomic Energy Commission, 1957. 82p. Available from U. S. Government Printing Office for $0.60.

Forty irradiation facilities, currently operative or scheduled to become operative soon, are described. Twenty-six of these are nuclear reactors suitable for irradiation use and the other 14 are gamma-ray facilities equipped with sources of kilocuries or more. Technical data on each facility, and information on the services provided and how to obtain them are included. (C.H.)

## COSMIC RADIATION

**12088**

COSMIC RAY NUCLEAR INTERACTIONS IN NITROGEN GAS. Saburo Miyake, Kensaku Hinotani, Itsuo Katsumata, and Tatsunosuke Kaneko (Osaka City Univ.). J. Phys. Soc. Japan 12, 845-54(1957) Aug.

The natural rate of occurence of nuclear interactions of cosmic ray N-component in which more than 5 Mev are given to charged secondary particles have been measured in the nitrogen filled high pressure cloud chamber at Mt. Norikura (2840 m above sea level and 25°N geomagnetic latitude). From the rate of occurence of number interactions, the vertical intensity of N-component was estimated at $(2.4 \pm 40\%) \cdot 10^{-3} \cdot E^{-1.4}\,cm^{-2}s^{-1}\,sr^{-1}Mev^{-1}$ for the energy range from 10 Mev to 100 Mev by assuming the geometrical cross section. These events may be considered to be the source of the cosmic ray N-component with an energy less

than that sufficient to produce nuclear interactions in the atmosphere, and it was shown that the spectrum of secondary particles was in accord with that of the latter. The absolute intensity of N-component was also consistent with that expected from the data of other energy regions in our previous paper. A possible scheme of the nuclear cascade was discussed in relation to the size distribution of the observed stars. (auth)

**12089**

AN EXPERIMENT ON AIR SHOWERS PRODUCED BY HIGH-ENERGY COSMIC RAYS. G. Clark, J. Earl, W. Kraushaar, J. Linsley, B. Rossi, and F. Scherb (Massachusetts Inst. of Tech., Cambridge). Nature 180, 353-6 (1957) Aug. 24.

**12090**

AN EXPERIMENT ON AIR SHOWERS PRODUCED BY HIGH-ENERGY COSMIC RAYS. G. Clark, J. Earl, W. Kraushaar, J. Linsley, B. Rossi, and F. Scherb (Massachusetts Inst. of Tech., Cambridge). Nature 180, 406-9 (1957) Aug. 31.

**12091**

THIN DOWN AND BREAKUP OF LARGE Z COSMIC RAY PRIMARY. A. G. Barkow and B. Chamany (Marquette Univ., Milwaukee, Wisc.) and R. E. McDaniel (New Mexico Coll. of Agriculture and Mechanical Arts, State Coll.). Nuovo cimento (10) 6, 125-9(1957) July.

A high-Z primary cosmic-ray particle is observed in G-5 emulsion exposed in Texas at an altitude of 104,000 ft. Thin-down measurements indicate a value of Z between 24 and 40. The thin down is accompanied by a partial breakup which permits an interesting determination of the charge on the primary, and suggests that the charge on the primary is between 35 and 40. (auth)

**12092**

ON THE IMPORTANCE OF RESEARCH. (ON THE IMPORTANCE OF RESEARCH IN COSMIC RADIATION). N. A. Dobrotin. Vestnik Akad. Nauk S.S.S.R. 27, No. 7, 15-17(1957) July. (In Russian)

Suggestions are offered for co-ordinated research in a cosmic radiation. (R.V.J.)

## CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

**12093** NYO-7079

Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy.

IMPERFECTIONS IN HEXAGONAL COBALT. Progress Report No. 23. C. R. Houska and B. L. Averbach. July 30, 1957. 26p. Contract (30-1)-1002, Scope III. $4.80 (ph OTS); $2.70(mf OTS).

The influence of local strain, fine particle size, and stacking faults on the diffraction pattern of hexagonal Co has been considered. Quantitative x-ray measurements showed that hexagonal Co produced by transformation was relatively free of local strain and particle size effects, but both growth and deformation faults were observed. It was also found that this hexagonal structure was composed of two types of material. One region contained random deformation faults, and the other region contained both random deformation and growth faults. The relative fraction of the two materials was measured, but the distribution of these two types of materials could not be determined. Cobalt specimens which were highly deformed and subsequently annealed without transformation contained a homogeneous distribution of random growth and deformation faults. It was also shown that extended dislocations would produce x-ray diffraction effects which were not observed. (auth)

**12094** AEC-tr-3017

ON THE MATERIAL CONSTANTS NECESSARY FOR THE DESCRIPTION OF THE ELASTIC PROPERTIES OF CRYSTALS. A. V. Stepanov. Translated by S. Rothman from Zhur. Tekh. Fiz. 25, 2203-8(1955). 7p.

The elastic properties of crystals (qualitatively correctly, quantitatively approximately) may in most cases be described by the assignment of only three material constants. (auth)

**12095** SCL-T-141

DISPLACEMENT OF CURIE TEMPERATURE BY HYDROSTATIC (OMNILATERAL) PRESSURE. (Über die Verschiebung der Curietemperatur durch allseitigen Druck). M. Kornetzki. Translated from Physik. Z. 44, 296-302(1943). 13p.

The question as to the dependence of the Curie temperature on a lattice distortion produced by a universal (hydrostatic) pressure has acquired new interest since the discovery that the exchange energy which is equivalent to the Curie temperature will also influence the technically important quantities of a ferromagnetic substance, namely: coercivity and initial permeability. The shift of the Curie temperature through hydrostatic pressure can be measured directly only when the Curie point is not too high. According to existing evaluation formulas, the displacement can be calculated also for alloys with a high Curie temperature, whereby those calculations will be approximate. There were, however, essential differences between the computed values and those derived from empirical measurements of about two powers of ten. An Fe-Ni alloy with 30% Ni was used to show that after a suitable definition of the Curie temperature, it is possible to obtain from the measurements a Curie point shift of about $-6 \times 10^{-3}$ degree/atm., a displacement which agrees exactly with the previously estimated value. Thereby it is possible to endow the value of the Curie point shift with a greater certainty, an order of magnitude which has been calculated for Fe. As for Ni-Cu alloys with about 30% Cu, the measurements yield, together with computations, considerably smaller values. The consequences ensuing from the dependence of the exchange energy on the lattice constant is discussed. (auth)

**12096**

EQUATIONS FOR A LATTICE GAS. II. MULTI-COMPONENT SYSTEMS. Howard B. Levine (Iowa State Coll., Ames). J. Chem. Phys. 27, 335-42(1957) Aug.

An expression is developed for $P/kT$ for a multi-component lattice gas with an arbitrary lattice as a multiple power series in a set of kth nearest-neighbor interaction paramters, $\lambda_{ab}^{k}$, where a and b index the components, with the coefficients functions of the activity set z. By straightforward differentiation, corresponding expressions are obtained for other thermodynamic variables, and also for the probability of finding a pair of particles of specified components on a pair of specified sites. A transformation is outlined which permits the substitution of the number density set $\rho$ for the activity set as independent variables. (auth)

**12097**

THE EFFECTS OF RADIATION ON THE NEAR INFRA-RED ABSORPTION SPECTRUM OF α-QUARTZ. E. W. J. Mitchell and J. D. Rigden (Univ. of Reading). Phil. Mag. (8) 2, 941-56(1957) Aug.

The variation of the absorption strength and spectrum in the region of 3 μ has been determined for different specimens of crystalline quartz and for x-ray, electron and pile irradiated crystals. It is shown that the 3 μ group of bands is associated with imperfections rather than harmonics or

combinations of lattice vibration frequencies, and that the imperfections are not Frenkel or Schottky defects. Two of the bands, 2.88 and 2.95 $\mu$, are anisotropic, having anisotropic, having anisotropic absorption ratios ($E_{\parallel} c/E_{\perp} c$)≤ 0.130 and ≤0.145 respectively. A band is induced by pile irradiation at 2.79 $\mu$ but tends to saturate at a low dose (<$10^{19}$n° $cm^{-2}$). The band is not produced by ionizing radiation. It is suggested that the 2.79 $\mu$ band may be due to O–H bond formation by association of hydrogen impurity with the products of atomic damage. This band is also anisotropic with a ratio of 0.71. Possible defect axis directions which could give the observed anisotropic ratios are discussed. (auth)

## ELECTRICAL DISCHARGE

**12098** NYO-7315

Princeton Univ., N. J. Project Matterhorn.

AN ENERGY PRINCIPLE FOR HYDROMAGNETIC STABILITY PROBLEMS. I[ra] B. Bernstein, E. A. Frieman, M[artin] D. Kruskal, and R. M. Kulsrud. Mar. 4, 1957. 59p. (PM-S-25). $1.75.

NYO-7896 is an appendix to this report.

The problem of the stability of static, highly conducting, fully ionized plasmas is investigated by means of an energy principle developed from one introduced by Lundquist. The derivation of the principle and the conditions under which it applies are given. The method is applied to find complete stability criteria for two types of equilibrium situations. The first concerns plasmas which are completely separated from the magnetic field by an interface. The second is the general axisymmetric system. (auth)

**12099** NYO-7896

Princeton Univ., N. J. Project Matterhorn.

AN ENERGY PRINCIPLE FOR HYDROMAGNETIC STABILITY PROBLEMS. I[ra] B. Bernstein, E. A. Frieman, M[artin] D. Kruskal, and R. M. Kulsrud. Mar. 21, 1957. 35p. (PM-S-25) (App.)).

This report is an appendix to NYO-7315.

The explicit derivation of the first-order force, the direct demonstration of self-adjointness, surfaces of discontinuity interior to the fluid, a form of $\delta W_f$ interpretable in terms of the differential geometry of the lines of force, a proof of the sufficiency of normalizing the component of $\xi$ in the $\nabla p$ direction, the pressure jump condition at a surface of discontinuity, the determination of the vacuum magnetic field, and conservation of energy and derivation of $\delta W$ in the case of a tensor pressure are presented. (M.H.R.)

**12100** SCL-T-123

TEMPERATURE MEASUREMENTS IN THE COLUMN OF A GERDIEN ARC. (Temperaturemessungen in der Saule eines Gerdien-Rogens). Rudolph Wilhelm Larenz. Translated from Z. Physik 129, 343-64(1951). 26p.

According to a procedure developed in the present study, the temperature distribution in the column of a Gerdien arc is measured between 55 and 500 amps. Temperatures up to 3400°K result in the axis of the column. It is shown that the theory developed by Riewe and Rompe is confirmed—namely the theory of the thermal conductivity of ionized gases in the temperature decrease of the arc, both in regard to the order of magnitude and to temperature course of the thermal conductivity. (auth)

**12101**

POWER FROM NUCLEAR FUSION. F. R. Paulsen. Atomics 8, 343-6(1957) Sept.

A typical experimental set-up for inducing nuclear fusion of light gaseous elements is diagrammed. A general review of the various aspects of the fusion process is given with emphasis on mass defect, the pinch effect, and the thermonuclear cycle. Both American and overseas work are reviewed. (M.H.R.)

**12102**

ON THE POSSIBILITY OF CONTROLLED POWER PRODUCTION USING THERMONUCLEAR FUSION. G. Kálmán, L. Pócs, G. Schmidt, and K. Simonyi (Inst. for Theoretical Electricity of the Polytechnical Univ., Budapest). Periodica Polytechnica 1, 53-71(1957).

A formula is derived which differs from the Stefan–Boltzmann law in respect of the plasma radiation. According to this the specific radiation output is independent of geometrical dimensions. Fusion power production and radiation reach equilibrium at a well-defined temperature independent of geometry and even of density. The possibilities of power production by accelerators are also discussed with an essentially negative result. The sketch of a scale-drawn reactor is reproduced here which helped to formulate the problems to be solved. (auth)

## ELECTRONS

**12103**

FORM FACTOR FOR THE EJECTION OF ELECTRONS FROM THE L-SUBSHELLS BY PROTONS. M. V. Mihailović. "J. Stefan" Inst. Repts. (Ljubljana) 3, 55-60 (1956) Oct.

Expressions for the form factor are derived, assuming the Born approximation for the bombarding proton, and using spherical coordinates. (auth)

**12104**

DIRECTIONAL CORRELATIONS OF $\beta$-RAYS. I. Hauser (State Univ. of Iowa, Iowa City). Nuovo cimento (10) 5, Suppl. No. 1, 182-221(1957).

Explicit formulas for directional correlation between $\beta$ particles and any succeeding nuclear radiation are derived and discussed. Topics are included on the reduced matrix elements, radiation parameters, first and second forbidden transitions, and allowed transitions. (M.H.R.)

## GASES

**12105** AECU-3178

Bureau of Mines. Div. of Explosives Technology, Pittsburgh.

FLAMMABILITY OF HYDROGEN–AIR–NITROGEN OXIDE MIXTURES. Final Report. Frank E. Scott and Michael G. Zabetakis. Apr. 9, 1956. 20p. (BM-3507). $3.30 (ph OTS); $2.40(mf OTS).

Limit-of-flammability data from tests on mixtures of $H_2$, air, and nitrogen oxides are presented in tabular and graphic form. (T.R.H.)

**12106**

FREE ENERGY FUNCTIONS FOR 54 GASEOUS ELEMENTS. Harwood G. Kolsky and Ruth M. Gilmer (Los Alamos Scientific Lab., N. Mex.) and Paul W. Gilles (Univ. of Kansas, Lawrence). J. Chem. Phys. 27, 494-5(1957) Aug.

Tables of the free energy functions for 54 elements, each considered as an ideal monatomic gas, were calculated using a Los Alamos Scientific Laboratory IBM 704 computer for the temperature range 0 to 8000°K. (auth)

## INSTRUMENTS

**12107** AECU-3544

DuMont (Allen B.) Labs., Inc. Tube Research Labs., Passaic, N. J.

DEVELOPMENT OF PHOTOMULTIPLIER TUBES. Re-

port No. 16 [for] period December 1, 1954 to February 28, 1955. Bernard R. Linden, Philip A. Snell, and Robert E. Rutherford. 11p. Contract AT(30-1)-1336. $3.30(ph OTS); $2.40(mf OTS).

Attempts to make a ¾ in. multiplier phototube with Ag-Mg dynodes have not proven successful. Various remedies are being tried and the one which seems to hold out most hope is the use of Cs-Sb dynodes. Work on plug-in glass bases is continuing and the equipment necessary for manufacturing them has been obtained. An ultra-violet sensitive tube was developed. Equipment for measuring transit time spreads in multiplier structures is being set up. (auth)

**12108** AECU-3546

Sandia Corp., Albuquerque, N. Mex.

A PULSER CIRCUIT FOR MAGNETIZING FERROMAGNETIC DEVICES. A. J. Shell. July 17, 1957. 12p. Contract AT(29-1)-789. (TM-171-57-51). $3.30(ph OTS); $2.40(mf OTS).

A single-pulse, high-current pulser used to magnetize ferromagnetic cores is described. The circuit is an R, L, C, combination designed to eliminate any spurious ringing. This makes it possible to obtain accurate waveforms of the current and voltage applied to the cores. From these waveforms, the magnetizing force applied to the cores and the flux change in the cores can be accurately determined. Also discussed are some special problems which were encountered when attempting to magnetize a large number of cores all threaded by a single winding. (auth)

**12109** CERN-57-28

European Organization for Nuclear Research, Geneva.

HELICAL LENSES. F. Krienen. July 1, 1957. 8p.

The helical lens may be used as a high pass filter with $\omega^2 = |A|$ determining the cut off momentum; or as a transmission line in which the configuration of particles with a given momentum repeats itself periodically along the line with $\cos \omega_1 T = \cos \omega_2 T = \pm 1$ determining the parameters; and finally positive focusing may be obtained, however, with unit magnification under rather strict conditions given by formulae. (auth)

**12110** NBS-3124

National Bureau of Standards. NBS-AEC Cryogenic Engineering Lab., Boulder, Colo.

COLD VALVES. Technical Memorandum No. 24. R. J. Richards, R. B. Jacobs, and S. B. Schwartz. Feb. 23, 1954. 19p. NBS Project 0306-20-2665. $3.30(ph OTS); $2.40 (mf OTS).

A cold valve is a device which is used to stop and/or regulate the flow of cold fluids. The fact that the fluid is cold imposes two design requirements which are not met in conventional valve design: 1) The valve mechanism must operate satisfactorily at extremely low temperatures. 2) The fluid flowing through the valve must be extremely well insulated from the ambient temperature to minimize the amount of energy transferred to the cold fluid. The unique problem in cold valve design arises in minimizing the heat leak through the operating mechanism. The available information on the cold valves which have been developed is discussed and evaluated. To facilitate the achievement of these objectives the available information on the performance of cold valves in service and the results of tests performed on these valves are presented. In addition, a standard procedure for testing cold valves is suggested. (auth)

**12111** SCDC-665

Sandia Corp., Albuquerque, N. Mex.

A WIDE-BAND MICROWAVE LINK FOR TELEMETERING. Raymond E. Glass. Mar. 25, 1957. 22p. Contract [AT (29-1)-789]. (TM-188-57-52). $0.25(OTS).

The microwave link operates in the 4-kmc frequency region and can be set up for any desired bandwidth between 40 to 250 megacycles. In its present state, the telemetering system uses a pulsed-frequency modulated carrier obtained by use of either a klystron or a voltage-tuneable magnetron. The receiver directly amplifies the carrier to a level of 427 dbm where it is amplitude limited and discriminated. This system has been used in the field and has proved to be quite reliable. Its use to date has been limited to measuring time intervals of 200 microseconds or less and to faithfully reproducing pulse shapes requiring up to 250-mc bandwidth. The various components utilized to accomplish the desired transmitting and receiving functions in this portion of the microwave band are described. (auth)

**12112** AEC-tr-2959

MEASUREMENT OF CORRELATION FUNCTIONS FOR PULSES IN TWO COMPUTER CHANNELS. I. V. Zomov (Zotov) and A. V. Kutsenko. Translated from Pribory i Tekh. Eksper. 1, 38-43(1956). 7p.

An apparatus has been developed for measuring the time correlation function for the pulses of two channels used for recording nuclear particles. Dead time at the inputs is constant and comes to 0.01 seconds. At 100% efficiency for the counters the correlation function for connected processes separated by a time interval of approximately 1 second has been measured over a period of 12 hours to an accuracy of 1%. A circuit has been developed for a multiplying device which acts on the principle of scaler and coincidence networks, and should find wide application for pulse techniques. (auth)

**12113** AEC-tr-3022

NEW METHOD, PROCESS, AND INSTRUMENTS OF INCIDENT-LIGHT MICROSCOPY. F. Gabler and C. Reichert. Translated from Radex Rundschau, Nos. 4/5, 147-52(1956). 11p.

A method, process, and instruments for the examination of surfaces by incident-light microscopy are given. (W.L.H.)

**12114** SCL-T-135

MEASURING APPARATUS FOR THE DETERMINATION OF VERY SMALL INDUCTANCES. (Messgerät zur Bestimmung sehr kleiner Induktivitäten). H. Brand and E. Schuon. Translated from Elektron. Rundschau 11, 65-7 (1957). 10p.

An apparatus for measuring inductance in the range between 1 nH and 500 nH ($nH = 10^{-9}$) is described. The measuring principle deviates from the customary bridge and resonance methods and transforms the measured inductance into the dual reactance over the transformer line where frequency is stable. At a certain length of the line the resonance occurs and the excess potential is recorded. The length of the line (the position of the shorting slide) determines the measured magnitude and the inductance. (R.V.J.)

**12115** SCL-T-136

A MOBILE MEASURING BOOTH FOR OSCILLOGRAPH RECORDING OF FAST HIGH-VOLTAGE PHENOMENA. (Eine fahrbare Messkabine zur oszillographischen Aufzeichnung schnell verlaufender Hochspannungsvorgänge). Wolfgang Herbst. Translated from Electrotech. Z. 77(A), 105-7(1956). 9p.

An undistorted oscillographic recording of electrical processes with voltages up to several MV presents considerable difficulties because of the effect of strong electrical fields upon the over-all measuring equipment. High

voltages require great distances between the measuring equipment and the test object in which the voltage course is to be measured. The long feeder lines falsify, especially in the case of high frequency, the actual curve form. It is often necessary to limit and to eliminate laboriously the undesirable compensation phenomena and other types of disturbances. (auth)

**12116** SCL-T-147

ELECTRICAL ALTIMETERS FOR AIRCRAFT. (Elektrische Hohenmesser fur Flugzeuge). E. Roessler. Translated by Marcel I. Weinreich from Elektron. Rundschau 10, 133-5(1956). 17p.

Among the numerous instruments which are used aboard aircraft, the electric altimeter is becoming increasingly more important, even though there are different opinions regarding it. The present paper touches upon its various areas of application and describes its present-day stage of development. (auth)

**12117**

TELEVISION AT CALDER HALL. Atomics 8, 347-8(1957) Sept.

Closed circuit television used for inspection of cavities in the graphite moderator at Calder Hall is described. The camera is designed to operate inside a cylindrical cavity 4 in. in diameter, at temperatures up to 200°C, while exposed to $\gamma$ rays. Details of the system and its use are included. (M.H.R.)

**12118**

NUCLEAR RESONANCE APPARATUS FOR RELATIVE MEASUREMENT OF A MAGNETIC FIELD. Stane Vrščaj. "J. Stefan" Inst. Repts. (Ljubljana) 3, 95-7(1956) Oct. (In German)

The apparatus served for relative measurement of magnetic field with larger magnet surfaces and used the interference frequency between 2 samples for determination of field strength differences at the test points. Two tenths $cm^3$ of ordinary water with 0.5% ferric nitrate served as a test sample. At 5000 gauss the proton resonance frequency amounts to 21.3M Hz. At a one gauss difference in magnetic flux density, the frequency differential is 4260 Hz. The test range was 900 to 5000 gauss, thus the inhomogeneity of the fields could not exceed 3 gauss/cm. (tr-auth)

**12119**

NORMAL PULSE GENERATOR AND SET FOR MEASURING OF SHORT TIME INTERVALS. F. Bremšak. "J. Stefan" Inst. Repts. (Ljubljana) 3, 99-104(1956) Oct.

**12120**

A MILLIMICROSECOND PULSE-SHAPING CIRCUIT. P. R. Orman and F. H. Wells (Atomic Energy Research Establishment, Harwell, Berks). Nuclear Instr. 1, 183-5(1957) July.

A pulse-shaping circuit is described which sharpens the output pulses from a secondary emission pulse generator, to produce negative pulses of one millimicrosecond rise-time and of seven volts amplitude at an output impedance of seventy ohms. The circuit is capable of being driven at a repetition frequency of 50 kc/s. (auth)

**12121**

X-RAY POWDER DIFFRACTION ASSEMBLY FOR STUDIES AT ELEVATED TEMPERATURES AND HIGH GAS PRESSURES. Edward J. Goon, John T. Mason, and Thomas R. P. Gibb, Jr. (Tufts Univ., Medford, Mass.). Rev. Sci. Instr. 28, 342-4(1957) May.

A high temperature-high pressure assembly has been designed to be used with a Straumanis-type powder camera and a modified oscillatory attachment. The assembly consists of a small resistance furnace with a cooling shield and a specimen holder. The furnace is capable of heating the sample to a maximum temperature of 500°C and the temperature of the sample can be controlled to within ± 1°C. The specimen holder which is constructed from Be and Monel metal, has withstood $H_2$ gas pressures above 600 psi at 500°C. The apparatus has been applied to the structural study of the system: U-$UH_4$-$H_2$ gas. The lattice parameter of $UH_4$ ($\beta$-tungsten structure) is reported for the temperature range, 25 to 500°C, with an accuracy of ± 0.001 A. (auth)

**12122**

LOW-FIELD NUCLEAR MAGNETIC RESONANCE SPECTROMETER. R. W. Mitchell and M. Eisner (A and M Coll. of Texas, College Station). Rev. Sci. Instr. 28, 624-8 (1957) Aug.

A nuclear magnetic resonance spectrometer has been constructed and its performance at 12 and 43 gauss is discussed. The magnetic field is obtained with an end corrected solenoid powered by batteries. The best resolution obtained is 10 microgauss at 12 gauss and 20 microgauss at 43 gauss over a 30 $cm^3$ sample. A twin-T bridge and a synchronous detector are employed for the nuclear resonance detection. Some of the measurements for which this instrument is suited are described and the results of relaxation time measurements for ethanol-water mixtures are presented. (auth)

**12123**

APPARATUS FOR PRECISE DETERMINATION OF DYNAMIC YOUNG'S MODULUS AND INTERNAL FRICTION AT ELEVATED TEMPERATURES. M. E. Fine (Northwestern Tech. Inst., Evanston, Ill.). Rev. Sci. Instr. 28, 643-5(1957) Aug.

Apparatus for determining Young's modulus and internal friction of metals at temperatures to 800°C is described. The resonant dynamic method with electrostatic transducers is used. The frequency range is 20 to 200 kc/sec. Data for aluminum and tungsten are given. (auth)

**12124**

PRECISION INTEGRATOR FOR BEAM CURRENT. R. J. Helmer and A. Hemmendinger (Los Alamos Scientific Lab., N. Mex.). Rev. Sci. Instr. 28, 649-51(1957) Aug.

A current integrator has been built in which a servo is used to charge a capacitor in discrete amounts so as to match within certain limits the integral of an input current. By keeping the discrete charge small and the repetition rate for the incremental charge high, one can for practical purposes achieve continuous operation. An instrument accurate to better than 0.1% and with input impedance of $5 \times 10^4$ ohms for the current range 0.1 to 30 $\mu$a is described. (auth)

## ISOTOPES

**12125**

COULOMB EXCITATION OF OSMIUM. Roland Barloutaud, Pierre Lehmann, and Antoine Lévèque. Compt. rend. 245, 523-6(1957) July 29. (In French)

The coulombian excitation of Os yields the following data: the first excited state of $Os^{188}$ is at 155 kev, the two primary $2^+$ levels of $Os^{190}$ are at 190 and 570 kev, and the two primary $2^+$ levels of $Os^{192}$ are at 206 and 496 kev. The reduced probability of transition has been measured. (tr-auth)

**12126**

ACHIEVEMENTS OF NUCLEAR PHYSICS IN PEACEFUL APPLICATIONS. Vestnik Akad. Nauk S.S.S.R. 27, No. 7, 79-96(1957) July. (In Russian)

Applications of radioactive and stable isotopes and radiation in industry and research were discussed at the All-

Union Scientific-Technical Conference on Applications of Isotopes, Moscow, April 4-13, 1957. (R.V.J.)

## ISOTOPE SEPARATION

**12127**

NEW RESEARCH DEVELOPMENTS FOR INDUSTRIAL SCALE ISOTOPE SEPARATION. S. Villani. Energia nucleare (Milan) 4, 187-95(1957) June. (In Italian)

Separation methods for $U^{235}$, $H^2$, $N^{15}$, and $B^{10}$ are discussed. (M.H.R.)

**12128**

ISOTOPIC ENRICHMENT BY SLOW EVAPORATION OF WATER. L. Knop and F. Stern. "J. Stefan" Inst. Repts. (Ljubljana) 3, 149-56(1956) Oct. (In German)

Experiments with slow evaporation of water indicate that a fixed $H_2O$-isotopic equilibrium exists as compared with atmospheric moisture. The equilibrium water contains more of the heavy isotope than normal water. (tr-auth)

## MASS SPECTROGRAPHY

**12129**

MASS ANALYSIS OF A HIGH FREQUENCY ION SOURCE FOR THE VAN DE GRAAFF ACCELERATOR. E. Cilenšek, F. Cvelbar, and V. Ramšak. "J. Stefan" Inst. Repts. (Ljubljana) 3, 87-94(1956) Oct. (In German)

A simple high frequency ion source was built for an electrostatic pulse generator. Later during the assembly operation on the pulse generator some improvement on this source was undertaken. First the source itself was somewhat modified, second a good focusing of the emitted ion beam of the source was effected through an advantageous lens assembly, and third the mass analysis of the ion beam was made possible by a transverse magnetic field induced in front of the collector's center. (tr-auth)

**12130**

THE THREE-STAGE RADIO FREQUENCY MASS SPECTROMETER. M. Ribarič. "J. Stefan" Inst. Repts. (Ljubljana) 3, 105-34(1956) Oct.

A detailed analysis of the operation of a three-stage radio frequency mass spectrometer and of the role played by some of its parameters is given. The operation of such a radio frequency mass spectrometer is explained. Further a study is made of the influence of the voltage applied to the radio frequency accelerating stages and the role of the spacings between the latter. It has been found that the resolving power of a radio frequency mass spectrometer and the ratio between the heights of the energy gain maxima depend on these parameters. The influence of the netlike field structure of the radio frequency accelerating stages is analyzed. The influence of the inhomogeneity of single potentials upon the resolving power and the shape of the resonance curve is discussed. The obtained results are in satisfactory agreement with the measurements. (auth)

**12131**

INVESTIGATIONS OF AXIALLY SYMMETRIC MAGNETIC FIELDS WITH SPATIAL BEAM FOCUSING AND SPIRAL SHAPED AXIS TRAJECTORY WITH SLOWLY CHANGING RADIUS. Yu. V. Vandakurov (Leningrad Inst. of Technological Physics.). Zhur. Tekh. Fiz. 27, 1319-29(1957) June. (In Russian)

**12132**

MASS SPECTROMETERS WITH RESOLVING POWER ORDER OF SEVERAL THOUSANDS. B. M. Mamyrin and B. N. Shustov (Leningrad Inst. of Technological Physics.). Zhur. Tekh. Fiz. 27, 1347-56(1957) June. (In Russian)

Application of magnetic resonance mass spectrometers for analytical studies of light mass are discussed. Methods are offered for increasing the power of the spectrometer for eliminating the background residue. Apparatus parameters are developed for working with light materials. The scheme and design of the apparatus are given in graphical form. (R.V.J.)

## MATHEMATICS

**12133** AF-SAM-57-57

Combustion Engineering, Inc. Reactor Development Div., Windsor, Conn. and School of Aviation Medicine, Randolph AFB, Texas.

A METHOD FOR IMPROVING THE PRECISION OF INVERSE SQUARE MEASUREMENTS. M. Slater and G. S. Melville. Oct. 11, 1956. 4p.

A precise, simple method has been demonstrated for the measurement of radiation sources that follow the inverse square law. The method consists in mechanical imposition of straight line constraint on the motion of source or detector to maintain constant zero and alignment errors. In general, these errors can both be made appreciably smaller than any practical value for the distance from the zero point to the detector and a linear function then may be found which fits the data with great accuracy. The slope of the line determines analytically the difference between the assumed and actual separation of effective centers of source and detector. The determination of source intensity is independent of any assumptions about the location of the effective centers of source or detector. (auth)

**12134** MURA-340

Midwestern Universities Research Assn., Madison, Wisc.

SOLUTIONS AND APPROXIMATE SOLUTIONS TO A HILL'S EQUATION AND THE MATHIEU EQUATION. Roger E. Mills. Aug. 12, 1957. 32p. Contract AT(11-1)-384. $6.30(ph OTS); $3.00(mf OTS).

A method, like that of Hill presented by Whittaker and Watson, is described for the solution of a Hill's equation whose periodic function may be of the type $f(N\Theta) = a_0 + \sum_{n=1}^{\infty} a_n \cos n N\Theta + \sum_{n=1}^{\infty} b_n \sin n N\Theta$. Approximate solutions are described. The special case of the Mathieu equation is treated as an example. (auth)

**12135** RM-234(RAND)

RAND Corp., Santa Monica, Calif.

A NOTE ON THE MONTE CARLO METHOD AND THE POTENTIAL EQUATION. R. Bellman. Sept. 1, 1949. 4p.

Possibility of applying the Monte Carlo method to the numerical solution of the potential equation is presented. The fundamental idea is that of forming a solution of one class of equations using solutions of another class. (auth)

**12136**

SOME NEW RELATIONS FOLLOWING FROM THE HERGLOTZ THEOREM. Masao Atoji (Iowa State Coll., Ames). Acta Cryst. 10, 464(1957) July.

**12137**

MULTIDIMENSIONAL INTEGRALS AND THE MONTE-CARLO METHOD. I. M. Sobol (Steklov Mathematical Inst., Acad. of Sciences, U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 114, 706-9(1957) June 1. (In Russian)

**12138**

APPLICATIONS OF LIAPOUNOV'S SECOND METHOD IN REACTOR DYNAMICS. W. K. Ergen, H. J. Lipkin, and J. A. Nohel (Oak Ridge National Lab., Tenn.). J. Math. Phys. 36, 36-48(1957) Apr.

## MEASURING INSTRUMENTS AND TECHNIQUES

**12139** NP-6388

[Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.]

SPECIAL COURSE OF LECTURES ON NUCLEONIC CIRCUITRY, D. C. AMPLIFIERS, ELECTROMETERS, AND MODULATED AMPLIFIERS. [1952?]. 7p.

Special problems and design considerations involved in amplifiers and electrometers for measuring small currents from ionization chambers, photocells, mass spectrometers, or particle accelerators are discussed. (T.R.H.)

**12140** AEC-tr-3007

CONSTRUCTION OF AN AUTOMATIC ADIABATIC CALORIMETER. APPLICATION TO THE MEASUREMENT OF RADIOACTIVE HALF-LIVES AND TO THE COMPARISON OF RADIUM STANDARDS. (Realisation d'un Dispositif Automatique de Micro-Calorimetrie Adiabatique. Application a la Mesure de Periodes Radioactives et a la Comparaison des Etalons de Radium). M. Lecoin and J. Robert. Translated by Marcel I. Weinreich from J. phys. radium 17, Suppl. No. 11, 150A-8A(1956). 29p.

The method of adiabatic microcalorimetry has been in use for many years, particularly at the Curie Laboratory, for the study of different phenomena connected with radioactivity. The improvements that have been introduced to this method led to the realization of an entirely automatic device which increases the precision of the measurements considerably. This device makes possible relative measurements of heat quantity, varying in certain proportions. The experimental results obtained until now concern the measurement of the half-life (period) of the Rn and the comparison of the Ra standards. (auth)

**12141** AEC-tr-3033

MEASUREMENT OF THE HALF-LIVES OF RADIOACTIVE ISOTOPES BY THE DIFFERENTIAL CHAMBER METHOD. B. S. Dzhelepov and O. E. Kraft. Translated from Vestnik Leningrad. Univ. No. 8, 97-111(1955). 20p.

**12142** SCL-T-132

CHEMICAL DOSIMETRY OF THE DIFFERENT RADIATIONS IN A NUCLEAR REACTOR. (Dosimétrie Chimique Des Différents Rayonnements D'un Réacteur Nucléaire). Jacques Pucheault. Translated from J. chim. phys. 53, 705-13(1956). 20p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 11-1994. (W.L.H.)

**12143**

A NEW RADIATION MONITOR. J. C. Harvey. Atomics 8, 356-7(1957) Sept.

An instrument designed to measure low levels of radioactivity in rocks that are not necessarily uraniferous is described. The arrangement is cheaper than a scintillation counter and consists of a G-M tube with a pulse integrating system using a high speed electro-mechanical counter. Transistorized throughout and powered by dry cells, it is light and adaptable to field work by prospectors. (M.H.R.)

**12144**

TRITIUM COUNTING IN GLASS PROPORTIONAL COUNTING TUBES. David R. Christman (Brookhaven National Lab., Upton, N. Y.). Chemist Analyst 46, 5-6(1957) Mar.

It was found that tritium could be counted in glass proportional counting tubes with silver cathode surfaces. It is first necessary to convert to dry $H_2$ or $CH_4$ or a mixture of the two. A counting rate of 10 dpm is detectable with a standard deviation of ± 10%. (T.R.H.)

**12145**

PARAMAGNETIC RESONANCE METHOD IN STUDIES OF ACTIVATORS IN PHOSPHORS. A. A. Manenkov, A. M. Prokhorov, et al. (Lebedev Inst. of Physics). Izvest Akad. Nauk S.S.S.R. 21, 779(1957) May. (In Russian)

A superheterogenic radiospectroscope was used in studies of the paramagnetic resonance in the phosphors SrS(Eu), $CaF_2$(Eu), SrS(Gd), and SrS(Tb) at room temperature. The Eu in phosphors was found in the divalent state ($Eu^{2+}$) while Gd and Tb were in the trivalent state ($Gd^{3+}$ and $Tb^{3+}$). The ratio of $Eu^{151}$ and $Eu^{153}$ nuclear magnetic moments ($\mu_{151}/\mu_{153} = 2.24 \pm 0.03$) was found on the $Eu^{2+}$ and $Eu^{3+}$ superfine spectra. The nuclear magneton value of $Eu^{151}$ and $Eu^{153}$ nuclear magnetic moments ($\mu_{153} \approx \mu_{151}$) ≈ 0.2 was evaluated. The complete article is published in Optika i Spectroskopia 2, 470(1957). (R.V.J.)

**12146**

RANDOM INTERCHANGE OF CIRCUITS WITH APPLICATIONS TO COUNTING RATE METERS AND FUNCTION GENERATORS. Roland M. Lichtenstein (General Electric Co., Schenectady, N. Y.). J. Appl. Phys. 28, 984-9(1957) Sept.

Two identical linear circuits are excited by generators furnishing equal and opposite voltages. Homologous portions of the two circuits are interchanged at random times with, on the average, r interchanges per unit time. Because of these interchanges, the currents in the remaining portions are irregular. A theorem is derived that permits one to calculate the statistical averages of these currents. It states that one may disregard the interchanging; instead, one merely replaces the complex frequency s by s + 2r in the circuit functions [e.g., the impedances Z(s)] of the portions that were being interchanged. On the basis of this theorem one may design counting rate meters with nonlinear (e.g., logarithmic) scale, useful in reactor instrumentation, and function generators for functions of practical importance, such as the logarithmic and exponential functions, and powers with arbitrary exponent. The nature of the function depends only on linear passive circuit elements, such as resistors and capacitors. (auth)

**12147**

CALCULATION OF THE IRRADIATION DOSE RECEIVED BY THE OVARIES DURING AN $I^{131}$ TREATMENT OR TEST. A. Bercy. J. belge radiol. 40, 333-45(1957). (In French)

**12148**

IN VIVO MEASUREMENT OF THYROIDAL RADIOIODINE: EFFECT OF "NECK SCATTER". Alan L. Orvis, Pierre Koenig, and Charles A. Owen, Jr. (Mayo Clinic and Mayo Foundation, Rochester, Minn.). J. Clin. Endocrinol. and Metabolism 17, 966-74(1957) Aug.

**12149**

DETERMINATION OF RADON IN THERMAL SPRINGS. B. Čerček. "J. Stefan" Inst. Repts. (Ljubljana) 3, 79-85 (1956) Oct.

A radiometric method and apparatus for quantitative assay of radon in liquids is described. The lower limit of detection is about $10^{-11}$ curie of radon activity. A survey of radioactivity of the most important Slovenian thermal springs is added. (auth)

**12150**

THE TIME-OF-FLIGHT TECHNIQUE APPLIED TO FAST NEUTRONS. K. G. Malmfors, J. Kjellman, and A. Nilsson (Nobel Inst. of Physics, Stockholm). Nuclear Instr. 1, 186-96(1957) July.

A system for the measurement of fast neutron velocities with the time-of-flight technique is described. The phase bunching of the extracted beam from a conventional cy-

clotron is used for the production of short bursts of neutrons. The integrated time-of-flight spectra are obtained by using a Tektronix 517 oscilloscope with a modified triggering device. The application of the system to a precision measurement of the mean energy of the accelerated protons is described. (auth)

**12151**

GLASS SCINTILLATORS FOR PROMPT DETECTION OF INTERMEDIATE ENERGY NEUTRONS. P. A. Egelstaff (A.E.R.E., Harwell, Didcot, Berks). Nuclear Instr. 1, 197-9(1957) July.

Borate and phosphate glasses have been made which dissolve organic scintillators. The use of such "glass scintillators" for the detection of neutrons has been investigated, and the most promising type is a heavy element containing phosphate glass. (auth)

**12152**

ON DIFFUSION CLOUD CHAMBERS. Hilding Slätis (Nobel Inst. of Physics, Stockholm). Nuclear Instr. 1, 213-26 (1957) July.

A short survey is given on the development of the diffusion cloud chamber. Langdorf's theory is briefly reproduced, and some important improvements in the theory made by Shutt and other investigators are mentioned. Diffusion cloud chambers are described, and photographs of tracks demonstrate the use of these chambers. (auth)

**12153**

AN APPLICATION OF MAGNETIC TAPE RECORDING TO NEUTRON TIME-OF-FLIGHT SPECTROSCOPY. E. R. Rae and F. W. K. Firk (Atomic Energy Research Establishment, Harwell). Nuclear Instr. 1, 227-31(1957) July.

The technique of recording nuclear pulses on a twin-track magnetic tape has been applied to the examination of the prompt gamma rays following the capture of a slow neutron. The pulse-height spectrum produced by the gamma rays in a NaI crystal spectrometer is recorded on one track and a pulse denoting the time-of-flight of the neutron on the other. In this way the spectra of gamma rays due to capture of a neutron into a number of different resonances are recorded simultaneously and can be reproduced individually by selecting the gamma ray pulses corresponding to the appropriate group of timing pulses and playing them back into a multi-channel pulse-height analyzer. The play-back time is a small fraction of the recording time so that the method, in addition to eliminating monitoring difficulties and providing a permanent record of the experiment, also leads to a considerable saving in time, both of the time-of-flight equipment and of the pulse-height analyzer. The gamma rays due to neutron capture in $Hg^{199}$ have been examined with this equipment, and the results are discussed. (auth)

**12154**

THE RESPONSE OF A LIQUID SCINTILLATION COUNTER TO EXTENSIVE AIR SHOWERS OF LOW DENSITY. M. H. Brennan (Univ. of Sydney, N.S.W.). Nuovo cimento (10) 6, 216-25(1957) July.

A large-area liquid scintillation counter suitable for experiments on extensive cosmic-ray air showers is described. Pulse-height distributions are given for vertically incident penetrating particles, the sea level cosmic-ray flux, and air shower particles. It is found that the scintillator is a more sensitive detector of the particles in cosmic-ray air showers than is a tray of Geiger counters of the same area. The greater sensitivity of the scintillator is explained in terms of its greater detection efficiency for the low-energy $\gamma$ rays present in an air shower. It is found that a value of 2.1 for the ratio of the density of $\gamma$ rays (as detected by the scintillator) to the density of electrons (as detected by the Geiger counter) is required to account for the increased sensitivity of the scintillation counter. (auth)

**12155**

A DEMONSTRATION OF PARITY NON-CONSERVATION IN $\beta$-DECAY. M. A. Grace, C. E. Johnson, R. G. Scurlock, and C. V. Sowter (Clarendon Lab., Oxford). Phil. Mag. (8) 2, 1050-3(1957) Aug.

The feasibility of detecting $\beta$ particles by the blackening of a photographic film inside a cryostat at 1°K was established, and this method of recording was used to measure the angular distribution of $\beta$ emission from $Co^{60}$. A backward-forward asymmetry was observed, thus confirming that parity is not conserved in $\beta$ decay. Although this detection method does not enable energy discrimination to be made, it has the merit of simplicity and of allowing the angular distribution to be measured simultaneously at different angles. Observations were confined to 0 and 180° directions. (M.H.R.)

**12156**

DESIGN AND CALIBRATION OF POCKET PERSONNEL DOSIMETERS FOR BETA RADIATION. Harry H. Hubbell, Jr., Raymond M. Johnson, and Robert D. Birkhoff (Oak Ridge National Lab., Tenn.). Radiology 69, 268-73(1957) Aug.

**12157**

MEASUREMENT OF NEUTRON SPECTRA BY USE OF NUCLEAR EMULSIONS LOADED WITH $Li^6$ GLASS SPECKS. J. H. Roberts and F. E. Kinney (Northwestern Univ., Evanston, Ill.). Rev. Sci. Instr. 28, 610-15(1957) Aug.

Type E1 Ilford emulsions loaded with specks of $Li^6$ glass were studied for the measurement of neutron spectra from ~50 to 1000 kev. The method is independent of the neutron directions. Resolutions of about 200 kev were obtained. Calibrations were made by exposure to monoergic neutrons at several energies, and the method was tested by neutron spectra determined independently from fission and long counter data. The theory of the reduction of track data neutron spectra is given. The results look promising for application to the measurement of neutron spectra in fast critical assemblies and for similar problems. (auth)

**12158**

HIGH-PRESSURE PROPORTIONAL COUNTER. T. E. Gilmer, Jr., R. Mace, and E. D. Palmatier (Univ. of North Carolina, Chapel Hill). Rev. Sci. Instr. 28, 634-5(1957) Aug.

A large-volume high-pressure proportional counter used in a study of the ionization energy losses of mu mesons is described. The details of construction for operation at approximately one hundred atmospheres pressure are given. (auth)

**12159**

GEIGER-MUELLER TUBES FOR INVESTIGATION OF EXTERNAL ELECTROSTATIC FIELDS. B. Sujak. Z. angew. Phys. 9, 404-7(1957) Aug. (In German)

**12160**

SMALL ANGLE SCATTERING OF X RAYS BY SUBMICROSCOPIC DEFECTS. S. N. Zhurkov and A. I. Slutsker (Leningrad Inst. of Technological Physics.). Zhur. Tekh. Fiz. 27, 1392-4(1957) June. (In Russian)

Descriptions are given for an improved slit detector method and for an apparatus developed for measuring x-ray scattering at extremely small angles. The apparatus is effective in measuring the submicroscopic structures of materials with weak scattering properties. (R.V.J.)

## MESONS

**12161** UCRL-3775

California. Univ., Berkeley. Radiation Lab. INTERACTIONS OF $K^-$ MESONS IN HYDROGEN. Luis W. Alvarez, Hugh Bradner, Paul Falk-Vairant, J. Donald Gow, Arthur H. Rosenfeld, Frank T. Solmitz, and Robert D. Tripp. July 19, 1957. 19p. Contract W-7405-eng-48. $0.75(OTS).

A total of 277 $K^-$ mesons have been stopped in a hydrogen bubble chamber, roughly doubling the number reported previously. Hyperon production ratios, lifetimes, decay-mode ratios, and decay angular distributions are statistically improved. Cross sections for $K^-$ interactions in flight are reported. (auth)

**12162**

ON THE RANGE SPECTRUM OF $\mu$-MESONS AT SEA-LEVEL AT GEOMAGNETIC LATITUDE 24°N. Shuji Fukui (Osaka Univ.) and Takashi Kitamura and Yojiro Murata (Osaka City Univ.). J. Phys. Soc. Japan 12, 854-63(1957) Aug.

Differential intensities of $\mu$ mesons at sea-level at 24°N have been measured for the residual range equivalent to from 44 to 430 g/cm$^2$ of the air using a delayed coincidence method. It was found that the obtained range spectrum was nearly flat for present ranges and was 20% lower than Rossi's curve which should be valid at geomagnetic latitude greater than 45°. The effect of the lateral displacement as well as the angular deflection of particles in the absorber was taken into account for the scattering correction. Mesons locally produced in the absorber was found to be at most a few % of all mesons that stop and decay in the apparatus. This fact suggests that the discrepancy between $\mu$ meson spectra by the absorption method and by the magnetic cloud chamber method can not be accounted for only by the local $\pi$ meson production. (auth)

**12163**

ON THE INTERACTION BETWEEN $\mu$-MESONS AND NUCLEONS. I. S. Shapiro, E. I. Dolinsky, and L. D. Blokhintsev (Moscow State Univ., U.S.S.R.). Nuclear Phys. 4, 273-6(1957) Aug.

The angular distribution and longitudinal polarization of neutrons produced in the capture of $\mu^-$ mesons by $\mu$-meso-hydrogen are computed. (auth)

**12164**

SYMMETRY OPERATIONS OF THE HILBERT SPACE AND SELECTION RULES CONCERNING THE INTERACTIONS OF BARYONS AND MESONS. G. Marx (Roland Eouvos Univ., Budapest) and G. Gyorgyi (Central Research Inst. for Physics, Budapest). Nuovo cimento (10) 5, Suppl. No. 1, 159-81(1957).

Some applications of charge conjugation and symmetry properties in isotopic space are presented in connection with the production of K-mesons and hyperons, and with the annihilation of antinucleons and antihyperons. (M.H.R.)

**12165**

VECTORIAL CHARGE DISPLACEMENT. D. C. Peaslee (Purdue Univ., Lafayette, Ind.). Nuovo cimento (10) 6, 1-6(1957) July.

The consequences are examined of recognizing an extreme symmetry between the nucleon and cascade ($\Xi$) particle. The simplest formalism for expressing this symmetry is to take the charge displacement number $a = q - I_z$ for heavy particles as the z-component of a second, independent vector A in charge space. This scheme makes evident the possibility of two independent charge conjugation operators C and C′ for heavy particles; it also has suggestive applications to the $\theta_1$, $\theta_2$ scheme and the $\pi$-e decay problem. Experimental tests for vectorial A appear remote; the scheme appears mainly as an ideal limiting case, which may be useful for comparison and contrast with the real situation. (auth)

**12166**

ANGULAR CORRELATION IN THE $\pi$-$\mu$-e DECAY OF COSMIC RAY MESONS. P. H. Fowler, P. S. Freier, C. M. G. Lattes, E. P. Ney, and S. J. St. Lorant (Univ. of Minnesota, Minneapolis). Nuovo cimento (10) 6, 63-8 (1957) July.

A measurement has been made of the angular correlation in the decay for mesons produced at high altitude by cosmic rays incident on a 22.4 liter emulsion stack. Within statistics the angular distribution of the electrons is isotropic. The value of "a" in the expression $dN/d\Omega = (1 + a \cos\theta)$ is $-0.03 \pm 0.04$. This result is in disagreement with the experiments using accelerator-produced mesons which show a backwards asymmetry with "a" = $-0.15 \pm 0.02$. Possible explanations for the difference are discussed. (auth)

**12167**

ON THE THEORY OF HYPERONS AND K-MESONS. J. Tiomno. Nuovo cimento (10) 6, 69-83(1957) July.

An analysis is made of the consequences of the well established law of conservation of "strangeness" on the schemes of quantum numbers attributed to hyperons and K mesons. It is shown that the usually accepted Gell-Mann-Nishijima scheme is not unique and that another scheme in which isotopic spin 0 is attributed to K mesons and $\frac{1}{2}$ to ($\Lambda$, $\Sigma$) particles is possible. A theory is developed based on general symmetry principles, with this new scheme, and it is shown that, at the stage when only interactions of K mesons with hyperons are introduced, it is equivalent to Schwinger's 4-dimensional (in isotopic spin space) theory. Some features of interactions of $\pi$ mesons with hyperons are considered, as well of weak interactions. One of these features is that for the interactions of the $\pi$ mesons with ($\Lambda$, $\Sigma$) particles the conservation of the isotopic spin (with the selection rule $\Delta I_3 = 0, \pm 1$) with the new definition of isotopic spin may be lost. (auth)

**12168**

AN ANALYSIS OF 419 $\tau$-MESON DECAYS. M. Baldo-Ceolin, A. Bonetti, W. D. B. Greening, S. Limentani, M. Merlin, and G. Vanderhaeghe. Nuovo cimento (10) 6, 84-97(1957) July.

A homogeneous sample of 419 $\tau$ decays found in nuclear emulsions exposed to the Berkeley bevatron has been used in the present analysis. Special attention has been given to reducing the effects of the experimental biases both for the scanning and for the analysis. The results show that the $\tau$ decay is nearly isotropic, corresponding in the Dalitz treatment to zero spin and negative parity. (auth)

**12169**

NUCLEAR INTERACTIONS OF NEUTRAL K-MESONS OF LONG LIFETIME. M. Baldo-Ceolin, C. C. Dilworth, W. F. Fry, W. D. B. Greening, H. Huzita, S. Limentani, and A. E. Sichirollo. Nuovo cimento (10) 6, 130-43(1957) July.

An emulsion stack was exposed to a neutral beam from the Berkeley bevatron. The target to stack distance was 9.5 ft, which excluded $\theta_1$ mesons from the stack. The plates were scanned for $K^-$, $\Sigma^\pm$, and hyperfragments which could have come from the nuclear interactions of the long-lived $\theta_2$ meson. Five $\Sigma^-$ and three $\Sigma^+$ hyperons have been found, all of which originated in small stars in the emulsions. In five cases the $\Sigma$ hyperon was accompanied by a light meson, presumably a $\pi$ meson, each of which had an energy of less than 150 Mev. In two cases the mass of the incoming particle could be measured, and was found to be

$(1000^{+30}_{-100})$ $m_e$ and $(995^{+75}_{-270})$ $m_e$, respectively. In addition, ten double stars with short connecting tracks have been observed which can be interpreted as hyperfragments. The production of the events in or near the stack by energetic nucleons, pions, or K mesons can be excluded. The events are interpreted as representing the nuclear interactions of long-lived $\theta_2$ mesons in the $\theta$ mode by the following reaction: $\theta_2 + \eta \rightarrow (\Sigma/\Lambda) + \pi$. (auth)

**12170**

THE DECAY OF A $\Sigma^+$ HYPERON-PROTON FRAGMENT. M. Baldo-Ceolin, W. F. Fry, W. D. B. Greening, H. Huzita, and S. Limentani. Nuovo cimento (10) 6, 144-9(1957) July.

An event has been found in an emulsion stack which is interpreted as a ($\Sigma^+$, proton) compound which decayed from rest intc a pion, a proton, and a neutron with an energy release of (106 ± 14) Mev. (auth)

**12171**

NOTE ON THE GAMMA DECAY OF NEUTRAL PIONS. J. Tiomno. Nuovo cimento (10) 6, 255-7(1957) July.

**12172**

PROPORTIONAL COUNTER MEASUREMENTS OF $\pi$-MESONIC X-RAYS. D. West and E. F. Bradley (Atomic Energy Research Establishment, Harwell). Phil. Mag. (8) 2, 957-76(1957) Aug.

A Xe filled proportional counter has proved to be a very useful instrument for the study of $\pi$-mesonic x rays from light elements. Measurements of the $K_\alpha$ energies from $Li^6$, $Li^7$, $Be^9$, $B^{10}$ and $B^{11}$ are described. Energy shifts due to the short range pion-nucleon forces are observed, confirming the scintillation counter measurements. The experimental values of the energy shift are fitted equally well by the theories of Deser or Karplus. Measurements of $L_\alpha$ energies are used to deduce a value for the $\pi$-meson mass equal to 272.5 ± 0.8 $m_e$. The natural broadening of the Be $K_\alpha$ line due to the short lifetime for capture of the $\pi$-meson from the 1s state has been measured. A width $\Gamma = 1.2 \pm 0.2$ kev was observed. Intensity ratios of $K_\alpha$ and $K_\beta$ and $L_\alpha$, $L_\beta$ and $L_\gamma$ lines are also reported. (auth)

**12173**

THE VARIATION OF THE MEAN LIFE OF MUONS WITH THE ATOMIC NUMBER OF ABSORBER. N. N. Biswas and M. S. Sinha. Trans. Bose Research Inst. Calcutta 19, 49-59 (1953-55).

The delayed coincidence technique has been used to observe the decay of a composite beam of positive and negative $\mu$ mesons at sea-level in Al, C, Pb and S absorbers. In cases of Al and S the points on a semi-logarithmic scale for the time intervals 0.6 to 4.0 $\mu$secs. fit two straight lines, one yielding the life time of the composite beam and the other that of the positives alone. The composite mean lives are found to be 1.58 ± 0.07, 2.15 ± 0.09, 1.48 ± 0.08 $\mu$secs. in Al, C, S respectively. The mean lives of positives in Al, Pb, and S are 2.35 ± 0.11, 2.23 ± 0.09 and 2.15 ± 0.14 $\mu$secs. respectively. It has been concluded that the composite mean lives are dependent on Z, and decreases with increase of Z. The mean life of the negatives in C is determined to be 1.93 ± 0.24 $\mu$secs. From the data obtained, the ratio of positive to negative mu mesons has been found to be 0.95 ± 0.16. This does not agree with the view of 20% excess of positive mesons and it is argued that the simple theory of meson production by the collision of a primary beam of protons with the air nuclei is not sufficient to account for the observed ratio. (auth)

**12174**

IDENTIFICATION OF PARTICLES FROM A PROBABLE $\Lambda^\circ$-DECAY. M. S. Sinha and N. C. Das. Trans. Bose Research Inst. Calcutta 19, 61-6(1953-55).

Two particles appearing to originate in a single nuclear interaction produced in the first plate of a multiplate cloud chamber stop in the fourth and the fifth plate respectively inside the chamber. On the basis of ionization vs. range curves the particles are identified as a $\pi$ meson and a proton. Notwithstanding the statistical nature of Coulomb scattering, the above identification gets support also from the observed multiple scattering vs. residual range. If the particles are assumed to be the decay products of an unstable $\Lambda^\circ$ particle, the mass of the neutral primary comes out to be (2192–2206) $m_e$, and the corresponding Q-value, as (41–47) Mev.—results in good agreement with the values already found. (auth)

**12175**

PRODUCTION OF $\theta^\circ$ FROM AN S-EVENT. M. S. Sinha and N. C. Das. Trans. Bose Research Inst. Calcutta 19, 73-5 (1953-55).

**12176**

MEAN LIFE OF $\mu$ MESONS IN ELEMENTS AND COMPOUNDS. N. N. Biswas. Trans. Bose Research Inst. Calcutta 19, 79-87(1953-55).

The composite mean life of $\mu$ mesons stopped in elements (C, Mg) and the compound (NaOH) of low atomic numbers has been determined using a four-channel delay discriminator circuit. Assuming that the $\mu^+/\mu^-$ ratio is nearly unity, the mean life of the negative $\mu$ mesons has been obtained to be equal to 2.04 ± 0.14 (carbon), 1.52 ± 0.14 (NaOH), microseconds. (auth)

## MICROWAVES

**12177** NP-6389

Columbia Univ., New York. Columbia Radiation Lab. RESEARCH INVESTIGATION DIRECTED TOWARD EXTENDING THE USEFUL RANGE OF THE ELECTROMAGNETIC SPECTRUM. Quarterly Progress Report No. 6 [for] March 16, 1957 through June 15, 1957. P. Kusch. June 15, 1957. 41p. Contract DA-36-039-SC-64630.

The testing of magnetrons continued, and developments in maser amplifiers and power oscillators continued. The antiferromagnetic resonance of $MnF_2$ and the quadrupole moment of $O^{17}$ were measured, and the hyperfine structure of the metastable state of singly ionized $He^3$ was observed. (See also NP-6200.) (T.R.H.)

**12178**

THEORY OF THE REBATRON—A RELATIVISTIC ELECTRON BUNCHING ACCELERATOR FOR USE IN MEGAVOLT ELECTRONICS. Paul D. Coleman (Univ. of Illinois, Urbana). J. Appl. Phys. 28, 927-35(1957) Sept.

Highly bunched electron beams in the 1 to 3 Mev range, having a sharply peaked velocity spectrum, represent a powerful attack on the submillimeter wave (100 to 3000 kmc/sec) generation problem. In this paper the theory of a rebatron for producing a high-energy beam, wherein both the current wave form and the velocity distribution function approach delta functions, is presented. Computations indicate that the emergent 1.5-Mev beam has an appreciable harmonic content up to harmonics as high as the 1000th and has a velocity spread of 0.07% for the electrons of interest. Pulsed beam powers of the order of 100,000 w should be possible using a 3 kmc/sec rebatron. (auth)

**12179**

DESIGN AND EVALUATION OF AN S-BAND REBATRON. Irving Kaufman and Paul D. Coleman (Univ. of Illinois, Urbana). J. Appl. Phys. 28, 936-44(1957) Sept.

A practical design of an S-band rebatron for producing a high power, bunched, megavolt electron beam, theoretically

possessing harmonic current frequencies in the submillimeter range is presented. An indirect experimental method of evaluating the beam obtained from the rebatron, based on measuring momenta spectra, gives very satisfactory agreement with theory. The validity of this indirect method of beam analysis is strengthened by a measurement of the ratio of the 26th beam harmonic current amplitudes under two different sets of conditions determined experimentally by momenta spectra measurements. No highly critical tolerance conditions are encountered in the investigation. (auth)

**12180**

THE HARMODOTRON—A MEGAVOLT ELECTRONICS MILLIMETER WAVE GENERATOR. Murray D. Sirkis and Paul D. Coleman (Univ. of Illinois, Urbana). J. Appl. Phys. 28, 944-50(1957) Sept.

A new method for the coherent generation of relatively high powers at submillimeter wavelengths through the electronic excitation at a single frequency of a selected higher order $TM_{0mn}$ mode in a cylindrical cavity which is large compared to the wavelength is investigated. The theoretical relationship between the generated power, P, the harmonic current component, $I_b$, and the wavelength, $\lambda$, is typically of the order of $P(\text{watts}) \simeq 3000[I_b\,(\text{amp})]^2[\lambda(\text{mn})]^{1/3}$ for a 1-Mev electron beam. Experimental measurements at a wavelength of 8.310 mn which successfully demonstrate the method are described. (auth)

## NEUTRONS

**12181** LA-608

Los Alamos Scientific Lab., N. Mex.

A THEOREM AND ITS APPLICATION TO FINITE TAMPERS. R. P. Feynman. Aug. 15, 1946. Decl. Aug. 14, 1957. 30p. Contract W-7405-Eng-36. $4.80(ph OTS); $2.70(mf OTS).

A theorem is derived which is useful in the analysis of neutron problems in which all neutrons have the same velocity. It is applied to determine extrapolated end-points, the asymptotic amplitude from a point source, and the neutron density at the surface of a medium. Formulas for the effect of finite tampers are derived by its aid, and their accuracy is discussed. (auth)

**12182** UCRL-3839

California. Univ., Berkeley. Radiation Lab.

NEUTRONS FROM ($\alpha$,n) SOURCES. Wilmot N. Hess. July 1957. 41p. Contract W-7405-eng-48. $7.80(ph OTS); $3.30(mf OTS).

The neutron energy spectra and yield for several ($\alpha$,n) neutron sources (Ra–Be, Po–Be, Po–B, Po–Li, Pu–Be, and Po–F) are calculated and compared with experimental values. (auth)

**12183**

ANTINEUTRONS. F. Oszuszky. Atompraxis 3, 323(1957). (In German)

The existence and properties of antineutrons are briefly reviewed. (L.T.W.)

**12184**

ALBEDO OF NON-STATIONARY NEUTRON CURRENTS (RS 3). M. Ribarič and J. Strnad. "J. Stefan" Inst. Repts. (Ljubljana) 3, 31-8(1956) Oct.

The changes of the albedo of time dependent neutron currents are discussed. Supposing that the elementary diffusion theory is valid, the calculations are made for a spherical, a plane, and a cylindrical boundary of an infinite reflector. Further some practical estimates and the cases in which the dynamic albedo can be approximated by the stationary one (with the inaccuracy p) are mentioned. If the relative changes of $J_{in}$ (t) during a time of $t > L/2\nu$ are small, it is possible (for a proper accuracy ~ 1%) to use the stationary albedo instead of the dynamic one depending on $J_{in}$ (t). Shortly after sudden jumps ($t > l_0$) the stationary albedo can likewise be used instead of the dynamic one. (auth)

**12185**

DYNAMIC PHENOMENA IN A REFLECTOR (RS 4). M. Ribarič and J. Strnad. "J. Stefan" Inst. Repts. (Ljubljana) 3, 39-44(1956) Oct.

The neutron flux density in the reflector for a time dependent flux density at the reflector boundary was investigated. This investigation is made using the elementary diffusion theory. The results are given for four special time changings of flux density at the boundary. The ratios $\Phi\,(\omega_0)/\Phi\,(\omega_0 = 0)$, $\Phi\,(t, x)/\Phi_s\,(t, x)$, and $\Phi\,(t, x)/\Phi\,(t \to \infty, x)$ in the case of a spherical, cylindrical, or plane boundary do not involve the geometrical shape of the boundary, depending only on the distance from the boundary. Therefore the results can be taken as approximations for any kind of similar boundary geometries, taking in account a proper average distance from the boundary. The equations give some practical estimates, which are important for choosing of the instrument location in a reflector. (auth)

## NUCLEAR PHYSICS

**12186** AECU-3549

Massachusetts Inst. of Tech., Cambridge. Lab. For Nuclear Science.

PROGRESS REPORT NO. 44 FOR THE PERIOD DECEMBER 1, 1956 THROUGH FEBRUARY 28, 1957. 70p. Contracts AT(30-1)-905 and Nonr-1841(16). $10.80 (ph OTS); $3.90(mf OTS).

The absorption of $Zn^{2+}$ on Dowex-1 from aqueous amine chloride solutions was studied and results are graphed. Distribution ratios from extraction of Nb and Ta as organic and chloro complexes are given. The wt. % of water in bis (2-chloro) ethyl ether in equilibrium with aqueous solutions of various concentrations of HCl, HBr, $HNO_3$, $HClO_4$, $H_2SO_4$, and LiCl was determined by Karl Fischer titration. The velocity spectrum of cosmic ray $\mu$ mesons at sea level is given. Further results of the large air shower experiment are graphed. The lateral distribution of the $\mu$ meson component of large air showers is presented. Data on the cosine of the angle between the directions of motion of $\pi^-$ and $\tau^+$ mesons were analyzed to determine the spin of the $\tau^+$ mesons. The gyromagnetic ratio of the 123-kev rotational 2+-state in $Sm^{152}$ was measured to be g = 0.34 ± 0.05. Excited states in $Mn^{55}$, $Cr^{52}$, $Co^{59}$, $Fe^{56}$, $Ag^{107}$, $Ag^{109}$, $Ni^{58}$, $Ni^{60}$, $P^{30}$, and $S^{33}$ are reported. The reaction $K^{39}(d,p)K^{40}$ was studied at 14 reaction angles from 10 to 130° with an input energy $E_d$ = 6.0 Mev. (For preceding period see AECU-3496.) (M.H.R.)

**12187**

FUNDAMENTAL CONCEPTS OF NUCLEAR PHYSICS. Werner Braunbek. Atomkern Energie 2, 273-5(1957) July. (In German)

**12188**

PROBABLE NUCLEAR INTERACTION OF A HYDROGEN HYPERNUCLEUS. R. Levi-Setti and W. Slater (Univ. of Chicago, Ill.). Nuovo cimento (10) 6, 51-62(1957) July.

A particle (A) of unit charge, mass (3.6 ± 1.1) proton masses, and velocity v = (0.26 ± 0.02)c, is emitted from a 4.5 Bev $\pi^-$ star in emulsion. After travelling 2.4 mm, particle A interacts with a nucleus of the emulsion, the

only visible product being a helium hypernucleus, identified by direct mass and charge measurements, and by its mesonic decay. The energy of particle A is insufficient to produce directly the observed $He_\Lambda$, and the multiple scattering and ionization results on track A are inconsistent with its being a heavy meson or hyperon interacting in flight. The most probable interpretation is to identify particle A as a hydrogen hypernucleus which interacts by charge exchange or proton pickup. (auth)

**12189**

«HANDED» PARTICLE OF SPIN ½ WITH FINITE MASS. S. Watanabe (IBM Research Lab., Poughkeepsie, N. Y.). Nuovo cimento (10) 6, 187-96(1957) July.

It is possible to formulate a four-component spinor theory for a particle of spin ½ with a definite chirality (handed-ness), which has a finite mass. Interaction between an achiral (nonhanded) spinor and a chiral spinor requires an eight-component frame-work. Such an interaction manifests a parity-violating property. Two formulations are possible: 1) The theory can be made invariant separately for time-reversal and for the combination of space-inversion and charge-conjugation, or 2) it can be made invariant for space and time inversion and for charge conjugation. The present theory may have applications for hyperons. The Salam-Lee-Yang-Landau type of neutrino theory can be derived from the present formalism for the case m = 0. (auth)

**12190**

MULTIPLE PRODUCTION OF PARTICLES AND HYDRODYNAMICAL ASPECT OF QUANTUM-THEORY OF FIELD. M. Namiki (Waseda Univ., Tokyo) and C. Iso (Tokyo Univ. of Education). Nuovo cimento (10) 6, 245-9 (1957) July.

**12191**

FERMI INTERACTION WITH NON-CONSERVATION OF «LEPTON CHARGE» AND OF PARITY. C. P. Enz (Swiss Federal Inst. of Tech., Zürich). Nuovo cimento (10) 6, 250-4(1957) July.

**12192**

THE ISOMERISM OF ELEMENTARY PARTICLES. Hiroomi Umezawa and Antoine Visconti (Univ. of Maryland, College Park). Nuclear Phys. 4, 224-33(1957) Aug.

Weak interactions are discussed from the point of view of the isomerism of elementary particles. A generalized gauge transformation is introduced to discuss the isomerism of the neutrino. A possible formulation for the isomerism of particles with finite masses is also pointed out. (auth)

**12193**

NEUTRONS AND POSITRONS. Ernesto E. Galloni. Scientific Contributions B1, No. 2, 61-145(1950). (In Spanish)

A basic review of the characteristics of neutrons and positrons, their interactions with matter, and the theories concerning them is given. (M.H.R.)

## NUCLEAR PROPERTIES

**12194** BNL-3341

Brookhaven National Lab., Upton, N. Y.

BISMUTH CROSS SECTIONS. Sophie Oleksa. Sept. 1955. 11p. $3.30(ph OTS); $2.40(mf OTS).

Data on various Bi cross sections in neutron energies up to 14 Mev are reported. The values of the total cross section, the inelastic scattering cross sections, $\sigma(n,2n)$, the capture cross sections $\sigma(n,\gamma)$, $\sigma(n,p)$, and $\sigma(n,\alpha)$, and the transport cross section are calculated. (R.V.J.)

**12195** BNL-3344

[Brookhaven National Lab., Upton, N. Y.]

THE INELASTIC SCATTERING CROSS SECTION OF BISMUTH. S. Oleksa and B. Mozer. Jan. 1954. 5p. $1.80(ph OTS); $1.80(mf OTS).

Calculations are presented for the inelastic scattering cross section of Bi in the energy range 0.75 to 2.50 Mev. (R.V.J.)

**12196**

NUCLEAR PHYSICAL DATA FROM THE USSR. W. Kunz. Atompraxis 3, 324-6(1957). (In German)

Neutron resonance parameters for $U^{233}$, $U^{235}$, and $Pu^{239}$ and fission values of $U^{235}$ for various neutron energies are tabulated. Excitation functions are graphed for the reactions $Mg^{24}(d,\alpha)Na^{22}$, $Fe^{54}(d,\alpha)Mn^{52}$, $Fe^{54}(d,n)Co^{55}$, $Zn^{66}(d,2n)Ga^{66}$, $Li^{7}(p,n)Be^{7}$, $B^{11}(p,\alpha)Be^{7}$, and $B^{11}(p,n)C^{11}$. The absorption cross section and resonance integral for $Pu^{240}$ for thermal neutrons are reported. Fission product ratios for $Pu^{239}$ fission are tabulated. The effective cross section for the reaction $Be^{9}(n,2n)Be^{8}$ is given. Nuclear spallation of Cu under 680-Mev proton bombardment is tabulated. The excitation function for the reaction $T(d,n)He^{4}$ is graphed. (L.T.W.)

**12197**

THE HALF-LIFE OF THORIUM C″. D. L. Baulch, H. A. David, and J. F. Duncan (Univ. of Melbourne). Australian J. Chem. 10, 85-7(1957) Feb.

The range in gases of Th C″ atoms produced by $\alpha$-recoil from Th B sources has recently been investigated by Baulch and Duncan. Thorium C″ decays with a short half-life to stable $Pb^{208}$. Each time measurements were made, a decay curve was determined, for extrapolation to zero time. In the course of this work, some 268 observations of the decay were made. Although the experiments were not originally designed for such a purpose, they provide a sufficient body of data for estimation of the half-life of Th C″ by statistical analysis. (auth)

**12198**

THE RANGE-ENERGY RELATION FOR $\alpha$-RECOIL ATOMS. D. L. Baulch and J. F. Duncan (Univ. of Melbourne). Australian J. Chem. 10, 112-27(1957) May.

The ranges of ThC″ $\alpha$-recoil atoms have been redetermined at pressures of $H_2$, Ar, and air from $10^{-3}$ to 30 mm, by collection on a Ag plate mounted 3 mm from a Pt source plate. The collector was maintained at a positive potential of 300 v to prevent collection of ions which migrate by diffusion. A similar method is used for RaA, with a (gaseous) Rn source. Previous work is critically discussed in terms of the corrections necessary to allow for geometrical features, and range straggling. Values of the mean range calculated both from previous work and from the present work are plotted against the recoil energy. Both the Flügge-Zimens recoil-range equation and the stopping power equation are shown to be unsatisfactory, and to rest on arguments which are subject to serious objection on both experimental and theoretical grounds. The recent Bohr treatment of collisions between recoil atoms and gaseous atoms is in much better agreement with the unobjectionable experimental data available. (auth)

**12199**

MEASUREMENT OF THERMAL NEUTRON ABSORPTION CROSS SECTION USING SPHERICAL SYMMETRY METHOD. A. M. Ghosh and N. K. Ganguly (Bose Inst., Calcutta). Indian J. Phys. 31, 285-96(1957) June.

An experimental arrangement is described and utilized to measure thermal neutron absorption cross section of Cl using spherical symmetry method. From the measured value it is shown that this method can effectively separate

the scattering effects and measure the absorption cross-section directly. Different sources of errors are discussed and their effects are estimated. (auth)

**12200**

EFFECTIVE FISSION CROSS-SECTIONS OF $^{233}U$, $^{235}U$, $^{239}Pu$, AND $^{240}Pu$ IN THE NEUTRON ENERGY RANGE 30 KEV-5 MEV. G. A. Dorofeev and Y. P. Dobrynin. J. Nuclear Energy 5, 217-25(1957).

The effective fission cross sections of $U^{233}$, $U^{235}$, $Pu^{239}$, and $Pu^{240}$ have been measured absolutely for photoneutrons from Sb + Be (~30 kev), Na + $D_2O$ (~250 kev), and Na + Be (~900 kev), from a "mock" fission source, and from Po-$\alpha$-Be. At 30 kev they are 3.06 ± 0.16, 2.21 ± 0.12, and 1.79 ± 0.11 barns for the first three of these isotopes, respectively. On increasing the neutron energy from 30 kev to 250 kev the cross sections of $U^{233}$ and $U^{235}$ fall by about 35%, thereafter remaining almost constant; that of $Pu^{239}$ falls 12% and then rises. The fission threshold of $Pu^{240}$ is between 250 kev and 900 kev, the effective cross sections at 900 kev and 5 Mev being ~1.4 barns. (auth)

**12201**

MEASUREMENTS OF THE EFFECTIVE THERMAL NEUTRON CROSS-SECTION AND THE RESONANCE ABSORPTION INTEGRAL OF $^{232}Th$. G. G. Myasishcheva, M. P. Anikina, L. L. Gol'din, and B. V. Ershler. J. Nuclear Energy 5, 230-5(1957).

The effective thermal neutron cross section of thorium ($\sigma_{th}$ = 7.31 ± 0.10 barn) and the resonance integral for thorium have been measured in a heavy-water reactor by an activation method. Gold, indium, and uranium were used as standards. Improved values for the effective thermal neutron cross section of indium ($\sigma_{th}$ = 162 ± 10 barn) and for the resonance integral of indium (RI = 2340 ± 200 barn) were determined. (auth)

**12202**

ELASTIC SCATTERING OF 5.7 Mev PROTONS. Minoru Takeda, Michiya Kondo, Ryuzo Nakasima, Chuin Hu, Takashi Yamazaki, and Shotaro Yamabe (Osaka Univ.) and Atsutomo Toi (Kobe Univ. of Mercantile Marine). J. Phys. Soc. Japan 12, 979-80(1957) Aug.

**12203**

MIXING RATIOS OF $2^+ \rightarrow 2^+$ TRANSITIONS IN SOME EVEN NUCLEI. Torsten Lindqvist and Ingvar Marklund (Inst. of Physics, Uppsala, Sweden). Nuclear Phys. 4, 189-205(1957) Aug.

Mixing ratios of $2^+ \rightarrow 2^+$ transitions in $Se^{78}$, $Te^{122}$, $Te^{124}$, and $Os^{186}$ have been measured by means of directional gamma-gamma correlations. Ten other similar cases in even nuclei have been summarized. The E2 radiation is dominating, although the amount of M1 radiation is measurable. The investigated transitions are examples of transitions between vibrational states, which according to theory should proceed by pure E2. The presence of M1 might indicate that the wave functions involved are not pure. The possibility of emission of E0 conversion electrons has been discussed. In six cases an upper limit has been given for the emission rate. (auth)

**12204**

INVESTIGATION OF CONVERSION LINES IN THE $\beta$-SPECTRUM OF $Ir^{192}$. V. M. Kelman, R. Ya. Metskhvarishvili, V. A. Romanov, and V. V. Tuchkevich (USSR Academy of Sciences, Leningrad). Nuclear Phys. 4, 240-7(1957) Aug.

A prism $\beta$ spectrometer with a resolving power of 0.04% was employed to study the conversion electron spectrum of excited $Pt^{192}$ and $Os^{192}$ produced in the disintegration of $Ir^{192}$. The conversion coefficient ratios K/L and $L_I : L_{II} : L_{III}$ have been determined for transition energies 136.3, 201.3, 205.8, 295.9, 308.5, 316.5, 468.0, and 604.5 kev; for the most intense transitions the ratios K/M, $M_I : M_{II} : M_{III}$, K/N and K/O have also been determined. All investigated transitions were found to be of the E2 or E2 + M1 type. The contribution of the M1 admixture has been determined. (auth)

**12205**

THE SCATTERING OF 181 Mev PROTONS OFF HELIUM. H. Tyrén, G. Tibell, and Th. A. J. Maris (Univ. of Uppsala). Nuclear Phys. 4, 277-81(1957) Aug.

The energy spectra of 181 Mev protons scattered off He have been recorded with a magnetic analyzer. Gaseous He was used as a target, and four angles were studied: 10.2, 14.2, 18.2, and 23.2. (auth)

**12206**

SHELL MODEL INTERPRETATION OF ENERGY LEVELS IN $Li^7$ AND $Be^7$. Jerry B. Marion (Univ. of Rochester, N. Y.). Nuclear Phys. 4, 282-6(1957) Aug.

The experimental evidence regarding the energy levels in $Li^7$ and $Be^7$ is reviewed and compared with the predictions of the shell model near the LS limit. It is found that the nucleon and $\alpha$ particle reduced widths strongly favor the 7.45-Mev state in $Li^7$ and the 7.13-Mev state in $Be^7$ being the $J = 5/2$ members of the $^4P$ multiplets rather than of the $^2F$ multiplets as previously assumed. None of the available experimental results is inconsistent with this identification. The location and a possible method for detecting the $^2F_{5/2}$ level is discussed. It is also suggested that the broad level structure near 6.5 Mev in $Li^7$ and $Be^7$ is not adequately described by the simple model proposed by Lane, and an alternative explanation is presented. (auth)

**12207**

ON THE 8.06 AND 8.70 Mev STATES IN $^{14}N$. C. Broude, L. L. Green, J. J. Singh, and J. C. Willmott (Univ. of Liverpool). Phil. Mag. (8) 2, 1006-10(1957) Aug.

The $\gamma$-ray decay scheme of the 8.70-Mev level in $N^{14}$ was investigated. The isotropy of the ground state transition from the 8.06-Mev state was studied to see if the ingoing particle is purely s-wave. If there is a substantial d-wave component present the number of states likely to mix in is increased and the whole situation is much more complex. (M.H.R.)

**12208**

HYPERFINE STRUCTURES OF THE RESONANCE LINES OF INDIUM 115. D. A. Jackson. Proc. Roy. Soc. (London) A241, 283-98(1957) Aug. 20.

The hyperfine structures of the two visible resonance lines of the arc spectrum of $In^{115}$ have been measured in the absorption of a multiple atomic beam of high collimation by means of a double Fabry-Perot interferometer; the combined instrumental and Doppler width of the absorption lines was less than 5 mK (0.005 $cm^{-1}$). By taking the necessary precautions to avoid systematic errors and by measuring a large number of different interferograms to reduce the random error it has been possible to measure the h.f.s. of the lines 4101 and 4511 A with an accuracy sufficient to allow the intervals of the terms $5\ ^2P_{3/2}$, $5\ ^2P_{1/2}$ and $6\ S_{1/2}$ to be determined with a probable error of 0.07 mK. The ratios of the three h.f.s. intervals of the term $5\ ^2P_{3/2}$ are in agreement, within the limits of the probable error, with those required on the assumption that the h.f.s. is due to nuclear magnetic dipole and electric quadrupole moments; the value found for the dipole coupling factor, A, is 8.083 ± 0.01 mK and for the quadrupole coupling factor, B, is 15.10 ± 0.1 mK. A comparison is made between the values of the h.f.s. intervals found in this work and those found by microwave measurements, since one of the principal aims of this research is to test the agreement between the results found by optical spectroscopic methods and by microwave methods. (auth)

**12209**

GAMMA SPECTRUM OF $Rh^{106}$ (130 ± 2 min). S. Mayo and S. J. Nassiff. Publs. com. nacl. energia atomica (Buenos Aires) Ser. fis. 1, 217-23(1957). (In Spanish)

The γ spectrum of $Rh^{106}$, half life 130 ± 2 min, was measured with a scintillation spectrometer with two NaI(Tl) crystals: one an inch in diameter and thickness and the other 1.5 in. in diameter and thickness. Gamma rays of the following energies and relative intensities were detected: 220 ± 5 kev (18%); 435 ± 5 kev (43%); 515 ± 5 kev (100%); 610 ± 5 kev (26%); 735 ± 5 kev (36%); 820 ± 5 kev (45%); 940 ± 10 kev; 1070 ± 5 kev (39%); 1225 ± 5 kev (24%); 1380 ± 10 kev; 1555 ± 5 kev (39%); 2260 ± 10 kev (1%). The intensities indicated in parentheses are an average of those obtained with both crystals. (tr-auth)

## NUCLEAR REACTORS

**12210** AECD-4244

Los Alamos Scientific Lab., N. Mex.

NEUTRON SPECTRUM FROM FAST REACTOR. Louis Rosen. [1947]. Decl. Aug. 20, 1957. 7p. Contract [W-7405-eng-36]. $1.80(ph OTS); $1.80(mf OTS).

A vacuum camera technique was used to determine the neutron spectrum emerging from a fast reactor in the energy range of 0.4 to 15 Mev as detected through a boron steel collimator. (R.V.J.)

**12211** AECD-4245

Los Alamos Scientific Lab., N. Mex.

CRITICAL MASSES OF MILDLY DILUTED $U^{235}$ SYSTEMS DERIVED FROM REACTIVITY CONTRIBUTION DATA. Leon B. Engle. [1956]. Decl. June 6, 1956. 11p. Contract [W-7405-Eng-36].

Reactivity contribution data, obtained from $U^{235}$ critical assemblies at Pajarito can be used to predict the effects of diluents on critical mass. The reactivity contribution data versus radius for diluents in a given assembly may be expressed as a single functional relationship between integral absorption and transport cross sections of the diluents. Using this relation, there can be obtained a general expression for the dependence of critical mass upon volume fraction and the effective absorption and transport cross sections of the diluent. (auth)

**12212** AECU-3478

Aeronutronic Systems, Inc., Glendale, Calif.

A SELECTION STUDY FOR AN ADVANCED ENGINEERING TEST REACTOR. Mar. 29, 1957. 149p. Contract AT(04-3)-130. (U-047). $0.70(OTS).

Preliminary design and cost studies were made of one homogeneous and two heterogeneous reactors for use in advanced engineering testing. Basic considerations were economy, high flux, and early startup date. The two heterogeneous designs use Al-clad, enriched U plates and $D_2O$ moderators. They differ in matrix geometry, one having a solid cylindrical matrix, the other a hollow cylindrical matrix with a $D_2O$-filled flux-trap in the center. The homogeneous design uses $UO_2SO_4$ in $D_2O$ and is primarily a scaled-up HRT. (D.E.B.)

**12213** ANL-5761

Argonne National Lab., Lemont, Ill.

PRELIMINARY DESIGN REQUIREMENTS; ARGONNE BOILING REACTOR (ARBOR) FACILITY. Revision I. L. W. Fromm, S. A. Bernsen, C. F. Bullinger, and J. F. Matousek. July 15, 1957. 159p. Contract W-31-109-eng-38. $4.25(OTS).

Descriptions of the functional requirements of the facility, together with preliminary concepts of methods for meeting them, are presented. The facility will provide the physical plant for experiments designed to yield data on performance and operation for various light and heavy water natural and forced circulation boiling reactor concepts over a wide range of temperature, pressure, and flow conditions. The design requirements and drawings are included. (M.H.R.)

**12214** BAW-1004

Babcock and Wilcox Co. Atomic Energy Div., Lynchburg, Va.

LIQUID METAL FUEL REACTOR EXPERIMENT QUARTERLY PROGRESS REPORT [FOR] NOVEMBER 1956–FEBRUARY 1957. 167p. Contract AT(30-1)-1940. $1.00 (OTS).

A general outline of the LMFRE test program was prepared. The program consists of tests and operations to be performed which will provide answers to unknowns in the LMFR concept. Preliminary specifications were developed for high-temperature neutron detectors and a continuous uranium monitoring system. Additional data were obtained in studies of fuel and blanket processing. The four-group parametric survey of the critical size, mass, and fission density of cylindrical $U^{235}$–Bi–C reactors was completed. Estimates of reactivity sources that must be compensated for by control rods were made. These include temperature coefficient, Xe and Sm over-ride, changes in other fission product levels, and experimental holes. Calculations of control rod worths were completed for a central rod and a ring of four black rods. Work was started on the hazards report. The calculations for direct exposure, cloud dose, fall-out dose, and inhalation exposure were made assuming the instantaneous release of 100% of the reactor saturated activity. Tentative core specifications were fixed for the graphite core tank reactor. The possibility of adding a breeding blanket to the LMFRE was analyzed. Two LMFR designs are discussed. One incorporates an integral graphite core and core tank, the other utilizes a Croloy core tank. Calculations were made to estimate startup source size, reflector heating, heat exchanger radiation levels, and decay heating. (D.E.B.)

**12215** BAW-1011

Babcock and Wilcox Co. Atomic Energy Div., Lynchburgh, Va.

LIQUID METAL FUEL REACTOR EXPERIMENT OBJECTIVES AND DESIGN PARAMETERS. May 1957. 11p. Contract AT(30-1)-1940. $0.15(OTS).

**12216** BAW-1012

Babcock and Wilcox Co. Atomic Energy Div., Lynchburg, Va.

LIQUID METAL FUEL REACTOR EXPERIMENT: THE ECONOMIC COMPARISON OF A LARGE-SCALE LMFR BREEDER AND BURNER. May 1957. 17p. Contract AT(30-1)-1940. $0.30(OTS).

**12217** BAW-1017

Babcock and Wilcox Co. Atomic Energy Div., Lynchburg, Va.

LIQUID METAL FUEL REACTOR EXPERIMENT: PRELIMINARY HAZARDS EVALUATION. G. R. Thomas. July 1957. 129p. Contract AT(30-1)-1940. $1.80(OTS).

The Liquid Metal Fuel Reactor Experiment (LMFRE) is designed to provide information necessary for the evaluation of the liquid metal concept and to yield data and experience necessary for the design of a large-scale LMFR. A description of the reactor, containment, and plant design is given. The associated environmental hazards are analyzed to illustrate the degree of containment necessary, and to aid in the selection of a site. (auth)

**12218** BNL-3338
Brookhaven National Lab., Upton, N. Y.
THEORY OF CONTROL RODS FOR THE LMFR-EXPERIMENT. J. Lamarsh. Jan. 13, 1956. 21p. $3.30(ph OTS); $2.40(mf OTS).

The control obtainable from the insertion of an array of control rods in the LMFR Experiment is discussed. The rods are assumed to be black to thermal neutrons. Two-group theory is applied throughout. A brief review is given of the two most widely used methods. The two-group control problem for a central rod surrounded by a ring of rods is presented. Results of numerical calculations for one central rod surrounded by a ring of equally spaced rods and rough calculations of the relevant LMFRE parameters are given. The optimum location of the ring is determined. The effect of surrounding the rods with a thin pipe of structural material is estimated using a method similar to the one used for determining scattering phase shifts. (auth)

**12219** BNL-3339
Brookhaven National Lab., Upton, N. Y.
GREY CONTROL RODS FOR THE LMFRE. J. Lamarsh. Apr. 2, 1956. 7p. $1.80(ph OTS); $1.80(mf OTS).

Calculations were made for two arrays of gray control rods. In one case the central rod was surrounded by a single ring of five rods; in the other it was surrounded by a ring of three rods. (R.V.J.)

**12220** BNL-3340
Brookhaven National Lab., Upton, N. Y.
THE TIME CONSTANT OF THE MODERATOR TEMPERATURE COEFFICIENT IN THE LMFRE. J. Fleck. Mar. 22, 1956. 4p. $1.80(ph OTS); $1.80(mf OTS).

An estimate is given of the time required for the moderator to reach thermal equilibrium and its effects on reactivity. (R.V.J.)

**12221** BNL-3345
Brookhaven National Lab., Upton, N. Y.
FLUX DISTRIBUTIONS AND SHIELDING EQUIPMENT FOR A PROPOSED LMFRE. K. Spinney. Mar. 14, 1956. 19p. $3.30(ph OTS); $2.40(mf OTS).

Two-group diffusion theory is used to calculate the critical fuel concentration and neutron flux distribution in the proposed system. These results are employed to determine the emergent currents of x rays and neutrons, and an estimate of the shielding requirements is made. (auth)

**12222** BNL-3346
Brookhaven National Lab., Upton, N. Y.
FURTHER CALCULATIONS ON THE LMFRE SHIELDING REQUIREMENTS. K. T. Spinney. May 8, 1956. 8p. $1.80(ph OTS); $1.80(mf OTS).

Calculations are given for the LMFR shielding design for $\gamma$ flux arising from neutron capture in BNL concrete, neutron shielding for the degasser and heat exchanger cells, and shielding requirements for radiation escaping through the control rod dome. (auth)

**12223** BNL-3347
Brookhaven National Lab., Upton, N. Y.
DELAYED NEUTRONS IN THE LMFRE AND THE RADIATION LOOP. T. Auerbach. Nov. 27, 1956. 10p. $1.80 (ph OTS); $1.80(mf OTS).

Calculations are developed which indicate the delayed neutron flux at various points in the LMFR fuel circuit and radiation loop. (D.E.B.)

**12224** BNL-3348
Brookhaven National Lab., Upton, N. Y.
EFFECTS ON REACTIVITY OF EXPERIMENTAL ABSORBERS. T. Auerbach. Nov. 9, 1956. 17p. $3.30 (ph OTS); $2.40(mf OTS).

The calculations used to predict the reactivity effects produced by inserting an absorber into an experimental hole of the BNL reactor are presented and discussed. The calculations are considered applicable to weak absorbers only. The specific case of a U–Bi radiation effects loop is treated. (D.E.B.)

**12225** CF-57-7-68
Oak Ridge National Lab., Tenn.
POSSIBILITY OF INTERCONNECTING THE HRT PRESSURIZERS WITH AN OPEN PIPE. H. A. McLain. July 17, 1957. 25p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

Calculations show that the transfer of solids from the core to the blanket side of the HRT is improbable when the two pressurizers are connected with an open pipe. (auth)

**12226** CF-57-8-78
Oak Ridge National Lab., Tenn.
AFTER RECOMBINERS FOR THE HRT. H. A. McLain. Aug. 15, 1957. 6p. Contract [W-7405-eng-26]. $1.80 (ph OTS); $1.80(mf OTS).

Installation of small recombiners at the vapor outlets of the present HRT recombiners is described. (T.R.H.)

**12227** CF-57-8-83
Oak Ridge National Lab., Tenn.
REACTIVITY LIFETIME OF A URANIUM–THORIUM BARE SLAB REACTOR. R. Benumof. Aug. 21, 1957. 11p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40 (mf OTS).

Some first order perturbation calculations based on a single group of thermal neutrons in a $U^{233}$–$Th^{232}$ infinite slab reactor have been performed. For a reactor of thickness 2H, the results indicate that the initial rate of change of effective multiplication constant with respect to time will be zero provided that the initial breeding ratio is approximately 1.15. For a constant breeding ratio of 1, the effective multiplication constant will decrease with time due to nonuniform poison buildup at a rate which is $\frac{1}{3}$ that occurring in a reactor with uniform buildup of fission product poisons. (auth)

**12228** HW-44054
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
ORGANIC REACTOR COOLANT SURVEY; TRIP REPORT. J. M. Atwood, M. W. Cook, and H. E. Hanthorn. July 9, 1956. 28p. Contract [W-31-109-Eng-52]. $4.80(ph OTS); $2.70(mf OTS).

Available data on organic coolants are summarized and experimental programs at various sites are described. Three materials are proposed for use at Hanford: eutectic of biphenyl, o-, and m-terphenyl; monoisopropyl biphenyl (MIPB); and solutions in MIPB of biphenyl, mixed terphenyls and naphthalene or mixtures of these. The corrosive effects, heat transfer and burnout properties, thermal and radiation stabilities, purification, hazards and physical properties of the first two of these materials are tabulated and discussed. (T.R.H.)

**12229** HW-50700
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
THE PLUTONIUM RECYCLE PROGRAM–A RÉSUMÉ OF THE CONCEPT, PROGRAM, AND FACILITIES. June 12, 1957. 50p. Contract W-31-109-Eng-52. $0.35(OTS).

The plutonium recycle concept of nuclear power reactor operation is briefly described. Salient differences between Pu and U fuels are analyzed for their effect on the technical feasibility of the recycle concept. The importance of this concept in conserving fissionable material is also described. Plutonium recycle is shown to be applicable to a

wide range of reactor types. A most attractive application is for reactors that utilize depleted U feed material. A discussion of economic factors shows that Pu is currently more expensive to use than $U^{235}$ for generating power in thermal reactors. In the future, however, when the value of Pu will be determined by free competition, and when new technological developments are applied, Pu will compete favorably with $U^{235}$ in this field. A $4,000,000 per year research and development program is described that will develop, in five to eight years, safe, economical methods of using Pu fuels in nuclear power reactors. An experimental plutonium recycle reactor, costing $14,300,000 is described in detail. The importance of this reactor in obtaining scientific and economic data, and in evaluating and demonstrating technological developments is emphasized. The importance of using Pu as a fuel in America's nuclear power industry has been recognized by the Atomic Energy Commission and the high probability of successfully developing the needed technology is described as strong incentive for the Hanford Laboratories to undertake this program. (auth)

**12230** HW-51328

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

EXPLORATORY CLADDING OF HANFORD FUEL ELEMENTS WITH A SCHLOEMANN CABLE-CLADDING PRESS. A. J. Karnie and G. F. Jacky. July 11, 1957. 9p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

Jacketing Hanford fuel elements using an extrusion cladding process was proposed and preliminary process evaluation carried out. Since this evaluation and subsequent information indicated the process might be attractive, it was desired to explore the feasibility of using conventional cable cladding equipment, and also expeditiously obtain extrusion-clad fuel elements for evaluation. Cladding tests were carried using an opposed ram extrusion press. A description of the equipment and the tests and a very preliminary appraisal of the quality of the clad fuel elements are presented. Fuel element cladding will be evaluated by extensive examination and testing at HAPO. (auth)

**12231** JENER-50

Joint Establishment For Nuclear Energy Research, Kjeller, Norway.

SHUT-DOWN CHARACTERISTICS OF JEEP. M. Y. El-Ibiary. May 21, 1957. 15p.

The decay characteristics of thermal neutrons and gamma rays in JEEP were taken during the annual shut-down. Measurements were made by ionization chambers placed in the B Channel. The ratio between the two fluxes, which is proportional to the error involved in measuring the neutron flux by the current in an uncompensated chamber, was found to have two maximal peaks occurring at about 5 min and 12 hrs from the time of shut-down. The effect of a cylindrical block of lead, in front of the chambers, on the ratio between the two fluxes was also measured. (auth)

**12232** KAPL-1754

Knolls Atomic Power Lab., Schenectady, N. Y.

RESONANCE ESCAPE PROBABILITY IN THERMAL REACTORS. J. B. Sampson and J. Chernick. Aug. 1, 1957. 68p. Contract W-31-109-Eng-52. $0.40(OTS).

Developments since early 1955 in the knowledge of the resonance escape probability in thermal reactors containing fertile material are reviewed and related to older work. Emphasis is placed upon presenting a physical understanding and in outlining methods of calculation. It is pointed out that the Russian and western measurements of the geometric dependence of the effective resonance integrals of lumps of fertile material agree adequately over the range of practical interest despite apparent differences in empirical formulas and in their points of view. The present knowledge of cross sections and of the theory is adequate to permit calculation of the resonance absorptions in homogeneous mixtures to within a few per cent. For heterogeneous systems various approximate methods of calculation and some Monte Carlo approaches are reviewed. (auth)

**12233** KAPL-M-LSB-2

Knolls Atomic Power Lab., Schenectady, N. Y.

APPLICATION OF THE VARIATIONAL METHOD TO THE CALCULATION OF FLUX RATIOS IN REPEATING SLAB ARRAYS. L. S. Bohl. June 27, 1957. 15p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

The variational method with constant trial functions has been applied to the calculation of flux ratios (self-shielding) in repeating slab arrays. Constant trial functions were assigned to several sub-divisions of the moderator in order to assess the dependence of the self-shielding upon moderator absorption. The flux ratios between moderator and fuel (or poison) slabs were found to be insensitive to moderator absorption. As numerical examples, the self-shielding is plotted versus fuel thickness for various values of the ratio of fuel to moderator thickness. Comparisons with experiment are discussed. (auth)

**12234** KAPL-M-SMS-65

Knolls Atomic Power Lab., Schenectady, N. Y.

S3G/S4G REACTOR ISOLATION VALVE CLOSURE DURING LEAK ISOLATION. A. J. Arker, M. Da Costa, and W. C. Smith, Jr. [June 1957]. 48p. Contract W-31-109-Eng-52. $7.80(ph OTS); $3.30(mf OTS).

One of the purposes of a coolant valve operating system is the isolation of the reactor from a coolant loop should a leak develop in the loop. Increased pressure differentials across the valve gates under leak conditions increase the required valve closing force. Tests were conducted on SAR isolation valves to determine the maximum leak under which proper operation could be obtained. The results are given. (D.E.B.)

**12235** KAPL-M-SMS-70

Knolls Atomic Power Lab., Schenectady, N. Y.

THE EFFECT OF CONTROL ROD MATERIALS ON CRUD ACTIVITY AND ACCESSIBILITY. J. W. Sapp. June 6, 1957. 25p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

The activity and dose rate build-up due to using twelve In–Cd–Ag control rods plus seven Hf rods in the SAR plant was investigated. The effect of replacing the Hf control rod rubbing shoes with Zr was also studied. (T.R.H.)

**12236** KAPL-M-SMS-72

Knolls Atomic Power Lab., Schenectady, N. Y.

FISSION PRODUCT RELEASE FROM KAPL-30 FUEL ELEMENT FAILURE. Frank J. Witt. June 13, 1957. 15p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

**12237** KAPL-M-SMS-75

Knolls Atomic Power Lab., Schenectady, N. Y.

STRESS ANALYSIS OF S3G/S4G EMERGENCY COOLING CONDENSER. T. H. Glasser. July 1, 1957. 44p. Contract W-31-109-Eng-52. $7.80(ph OTS); $3.30(mf OTS).

Stresses are estimated in the following areas of the S3G/S4G emergency cooling condenser: head to tubesheet junction, shell to tubesheet junction, bimetallic weld between tubesheets, tubes, tubesheet and inlet nozzle. Life

estimates are made on those parts having the most severe cyclic service. (auth)

**12238** KAPL-M-SP-10

Knolls Atomic Power Lab., Schenectady, N. Y.

APPLICATION OF THE ABSORPTION AREA METHOD TO THREE GROUP DIFFUSION THEORY PROBLEMS. S. Pearlstein. July 2, 1957. 21p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

The absorption area method allows rod absorptions to be considered without treating the rods as discrete boundaries. The source neutrons for a rod absorbing neutron energy group are reduced in proportion to the rod absorption area. This memo presents rod absorption factors based on absorption area calculations that may be applied in any reactor region penetrated by the rods. The factors derived are dependent on the core and rod composition, rod geometry, and includes rod interaction effects. (auth)

**12239** NAA-SR-1873

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

REACTOR DESIGN AND EVALUATION PROGRESS REPORT [FOR] MAY 1954–DECEMBER 1956. R. J. Beeley, ed. June 1, 1957. 99p. Contract AT(11-1)-GEN-8. $0.50(OTS).

Studies were conducted on the following: organic moderated reactor systems, nuclear and heat-transfer characteristics, and possible coolant activity; the number of neutron energy groups required to obtain reliable flux and power distributions from reactor calculations; modification of the transport equation to include hydrogenous and inelastic scattering during slowing down; and development of a rapid system of reactor calculation for two-region, three-group flux distributions. (For preceding period see NAA-SR-1029.) (auth)

**12240** NAA-SR-1938

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

REACTOR EVALUATION QUARTERLY PROGRESS REPORT [FOR] JANUARY–MARCH 1957. R. J. Beeley, ed. June 15, 1957. 29p. Contract AT-11-1-GEN-8. $0.25 (OTS).

Study of a fuel cycle involving Pu feedback with natural U feed material has been initiated; the study is slanted toward large organic moderated reactors. A study was made of the potential use of nuclear reactors for process heat in the sugar and in the pulp and paper industries since these industries use large amounts of process steam. It was found that the use of nuclear reactors would be feasible with nuclear reactors of over 40-Mw thermal power. The principal findings of this study are summarized for each of these industries in advance of a detailed topical report. Various methods of high-activity fission product waste disposal were considered; the present method of storage in large underground tanks can be considered only as a temporary expedient. Permanent methods of disposal must be found if an ever-growing waste-tank farm is to be prevented. Disposal in the ocean of liquid or package projectiles has too many uncertainties to warrant consideration. Permanent disposal in montmorillonite clay or in aluminum oxide appears promising for land disposal and even ocean disposal. A number of permanent disposal methods are under development to obtain the objectives of maximum use and ultimate safe confinement at low cost. The problem of disposal, though serious, does not appear as insurmountable as is sometimes depicted. (For preceding period see NAA-SR-1873.) (auth)

**12241** NYO-4849

Advanced Scientific Techniques Research Associates, Milford, Conn.

CONCEPTUAL DESIGN OF AN ADVANCED ENGINEERING TEST REACTOR. R. G. Mallon, J. Saldick, and R. E. Gibbons. Mar. 1, 1957. 122p. Contract AT(30-1)-1986. (ASTRA-200-E-1.1). $0.80(OTS).

A conceptual design for an Advanced Engineering Test Reactor is described. The reactor is a large graphite assembly penetrated by parallel Zircaloy tubes through which flows a heavy water solution of $UO_2SO_4$. Reactor power is 220 Mw. Reactor test facilities include nine vertical through-holes having thermal flux greater than $1 \times 10^{15}$. The central through-hole is 12 in. square and has a thermal flux of $1.9 \times 10^{15}$. The reactor provides a favorable environment for high temperature tests. Total cost of engineering and construction of the reactor and associated plant is estimated to be $30,000,000. (auth)

**12242** WAPD-BT-1

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

BETTIS TECHNICAL REVIEW. VOLUME 1, NO. 1. REACTOR AND PLANT ENGINEERING. May 1957. 215p. Contract AT-11-1-GEN-14 and appropriate NObs Contracts. $1.00(OTS).

Methods developed by Westinghouse for evaluating mechanical and thermal shock and stresses, temperature distributions, and heat transfer conditions in reactor components are described. (D.E.B.)

**12243** WAPD-PWR-CP-2541

[Westinghouse Electric Corp. Bettis Plant, Pittsburgh.]

FEASIBILITY OF HIGH pH COOLANT FOR PWR; PRELIMINARY REPORT. W. T. Lindsay, Jr. [1956]. 20p. $3.30(ph OTS); $2.40(mf OTS).

**12244** WAPD-PWR-PMM-634

Westinghouse Electric Corp., Bettis Plant, Pittsburgh.

PWR ALTERNATE CONTROL ROD MATERIAL PROGRAM. Aug. 15, 1956. 24p. $4.80(ph OTS); $2.70(mf OTS).

A summary outline of the experimental data obtained on the PWR alternate control rod materials program is given. (W.L.H.)

**12245** WAPD-PWR-PMM-662

[Westinghouse Electric Corp., Bettis Plant, Pittsburgh.]

PWR ALTERNATE CONTROL ROD MATERIAL PROGRAM. Dec. 15, 1956. 34p. $6.30(ph OTS); $3.00(mf OTS).

A summary outline of the experimental data obtained on the PWR alternate control rod material is given. (W.L.H.)

**12246** YAEC-22

Westinghouse Electric Corp. Commercial Atomic Power, Pittsburgh.

INSTRUMENTATION AND CONTROL PRELIMINARY FUNCTIONAL REQUIREMENTS. B. H. Axelson, S. N. Ehrenpreis, S. M. Cantor, and C. F. Obermesser. Apr. 26, 1957. 72p. For Yankee Atomic Electric Co. Contract AT(30-3)-222, Subcontract No. 1. $12.30(ph OTS); $4.50 (mf OTS).

The instrumentation and control for the primary side of the Yankee Plant excluding the nuclear instruments, reactor control, and control board are described. The preliminary functional requirements for the systems noted include the over-all objectives that the fluid system is to perform. Also the over-all objectives for the instrumentation and control are noted with reference to detecting, controlling and indication of the various parameters. A detailed description of the instrumentation is given which will include the general type of instruments used and what functions they perform in the system. A block diagram of

the systems is included to show where the instruments are relatively located in the actual fluid system. A bill of material is also included which lists all the instruments with their corresponding functions and also notes the type of instrument that is to be used. (auth)

**12247** YAEC-23

Westinghouse Electric Corp. Commercial Atomic Power, Pittsburgh.

CONCEPTUAL STUDY OF THE FUEL HANDLING SYSTEM. E. V. Anderson and P. B. Haga. Apr. 17, 1957. 34p. For Yankee Atomic Electric Co. Contract AT(30-3)-222, Subcontract No. 1. $6.30(ph OTS); $3.00(mf OTS).

Seven different handling systems for replacing the spent fuel and control rods in a pressurized water reactor are described and evaluated. One system is described completely including a list of refueling steps, a list of refueling equipment, and an estimate of the time and men required for the refueling operation. Each of the other six systems are described by noting the manner in which they differ from the first system. Drawings are given for all systems. Factors to be considered in the selection of a fuel handling system are discussed. (auth)

**12248**

DOUNREAY'S FAST REACTOR. Atomics 8, 336-8, 342 (1957) Sept.

The Dounreay Fast Breeder Reactor is discussed. Topics included are the heat cycle, shielding, core and blanket, heat exchanger, charge and discharge, control and instrumentation, power and auxiliaries, and the sphere. (M.H.R.)

**12249**

WESTINGHOUSE EXPERIMENTAL REACTOR. Atomkern Energie 2, 263-6(1957) July. (In German)

**12250**

THE DESIGN OF A NUCLEAR REACTOR PLANT AS AN ENGINEERING PROBLEM. W. Mialki. Atompraxis 3, 277-91(1957). (In German)

**12251**

A BILLION ELECTRON VOLT ACCELERATOR BUILT ON THE PRINCIPLE OF THE SYNCHROTRON. E. Bodenstedt. Atompraxis 3, 291-4(1957). (In German)

**12252**

REACTORS WITH FISSION MATERIAL IN THE FORM OF LIQUID METAL. P. Weinzierl. Atompraxis 3, 319-21 (1957). (In German)

**12253**

FRANKFURT EXPERIMENTAL REACTOR. Erwin Schopper (Univ. of Frankfurt). Die Atomwirtschaft 2, 217-24 (1957) July-Aug. (In German)

**12254**

YIELDS IN $U^{235}$ THERMAL NEUTRON FISSION. A. P. Baerg and Rosalie M. Bartholomew (Atomic Energy of Canada Ltd., Chalk River, Ontario). Can. J. Chem. 35, 980-5(1957) Sept.

Quantitative ion exchange and 4π counting techniques have been used to measure the yields of four nuclides not previously determined by mass spectrometric analysis. Values of 6.57, 6.30, 4.74, and 5.71% were obtained respectively for $Ba^{139}$, $La^{141}$, $Sr^{89}$, and $Sr^{91}$ relative to a value of 6.32% for the yield of $Ba^{140}$. A precision better than 1.3% was achieved in the measurements. (auth)

**12255**

MUNICH EXPERIMENTAL REACTOR. Die Atomwirtschaft 2, 225-31(1957) July-Aug. (In German)

**12256**

BERLIN EXPERIMENTAL REACTOR. Die Atomwirtschaft 2, 232(1957) July-Aug. (In German)

**12257**

HAMBURG EXPERIMENTAL REACTOR. Wolfgang Junkermann. Die Atomwirtschaft 2, 233-8(1957) July-Aug. (In German)

**12258**

JOINT ATOMIC RESEARCH ESTABLISHMENT IN NORDRHEIN-WESTPHALIA. H. C. Leo Brandt. Die Atomwirtschaft 2, 247-52(1957) July-Aug. (In German)

**12259**

A SHORT TECHNICAL DESCRIPTION OF THE EXPERIMENTAL ATOMIC POWER STATION OF RWE. Heinrich Mandel. Die Atomwirtschaft 2, 253-5(1957) July-Aug. (In German)

**12260**

SOLUTION OF SOME NUCLEAR REACTOR PROBLEMS BY THE RESISTANCE-NETWORK ANALOGUE METHOD. II. REPRESENTATION OF TWO VELOCITY GROUPS.

G. Liebmann (Associated Electrical Industries Ltd., Aldermaston, Berks). J. Nuclear Energy 5, 169-85(1957).

The "two-group" partial differential equations for reactors of axial symmetry, and with anisotropic neutron diffusion properties, are converted into finite difference equations. These are then represented by the current flow in resistance networks, the fast- and slow-neutron fluxes being represented by the network voltages. The resulting resistance-network analogue is similar to the "cascaded" network for the solution of the biharmonic equation, but does not involve some of the approximations made in this earlier technique. A convenient and fast measuring technique is described which is used in obtaining the correct solution by an iterative process of readjusting currents fed into the analog. Experimental work has confirmed that this method leads to solutions in which the neutron fluxes can be determined to better than 1%, and the critical neutron multiplication constant k to better than 0.1%. This work also sheds some light on the truncation error of the solution, and on the convergence rate of the iteration process. Design data for an (r,z) analog with unequal meshes are given, and the technique for critical size determination is outlined. (auth)

**12261**

A LOW-POWER HIGH-THERMAL-FLUX EXPERIMENTAL NUCLEAR REACTOR. M. Osredkar and R. Stephenson (New York Univ.). J. Nuclear Energy 5, 210-14(1957).

An attempt has been made to study, using the simplest methods, the inside-reflected thermal and fast reactors, with the aim to find possibly the best solution for a high-thermal-flux, low-power experimental reactor. Consideration of various arrangements of thermal and fast reactors with central-region reflector (inside-reflector) has shown that a reactor could be designed having a higher thermal flux, not by achieving a better heat removal from the reactor core, but by keeping the fission only in the fast region and restricting thermalization of neutrons to the inside reflector. (auth)

**12262**

THE PHYSICAL PARAMETERS OF THE AQUEOUS HOMOGENEOUS REACTOR AS FUNCTIONS OF TEMPERATURE AND REFLECTOR THICKNESS (RS 1). A. Peterlin and R. Kladnik. "J. Stefan" Inst. Repts. (Ljubljana) 3, 5-18(1956) Oct.

The critical radii and masses for the spherical homogeneous light and heavy water zero power reactor using 20% enriched $UO_2SO_4$ were calculated for different infinite reflectors ($H_2O$, graphite, $D_2O$) and different thicknesses of the $D_2O$ reflector in the temperature range from 25 to 200°C. The reactor savings due to the $D_2O$ reflector of

varying thickness were also determined for the infinite cylinder. Special attention was given to the problem of reactor stability and of regulating the reactivity at different temperatures by changing only the amount of the reflector. In the case of $H_2O$ moderator the one group theory was used and in the case of $D_2O$ the two group. (auth)

**12263**

BOILING COLUMN HOMOGENEOUS REACTOR WITH ADJUSTABLE REFLECTOR LEVEL (RS 2). A. Peterlin. "J. Stefan" Inst. Repts. (Ljubljana) 3, 19-30(1956) Oct.

Some simple homogeneous reactor proposals are considered which under favorable conditions could also be used for power generation experiments. The corrosion problem in the case of a homogeneous reactor is appreciably reduced and confined to the active core vessel when the fuel solution is allowed to boil freely, the generated steam taking away the fission heat. At intermediate power density the steam can be separated from the boiling solution inside the reactor tank so that no external fuel solution containing circuit is necessary. That reduces the fuel inventory and permits a simple, inexpensive construction and operation of the reactor. By the variable level in the water jacket the reactivity can be varied in wide limits and the reactor adjusted to any power demand and temperature compatible with its capacity. No safety and control rods are necessary, the reactor can be started and shut down by filling and emptying the water jacket only. In case of emergency it can be emptied through a rupture disk and so the reactor shut down without any contamination by the fuel solution. (auth)

**12264**

NEUTRON POISONS IN THE HOMOGENEOUS REACTOR (RS 5). B. Čerček. "J. Stefan" Inst. Repts. (Ljubljana) 3, 45-53(1956) Oct.

The concentrations of neutron poisons with high thermal neutron cross sections, the total fission-product poisoning with nonvolatile neutron poisons, and reactivity control by poisoning with $Cd^{113}$ are calculated for continuous operation with constant neutron flux and fuel concentration ($U^{235}$). The results are presented by graphs and equations governing the fission-product formation as a function of fuel irradiation-time. (auth)

**12265**

SOME PROBLEMS OF APPLICATION AND PRACTICAL DESIGN OF NEUTRON AMPLIFIERS I. A. Neszmélyi and K. Simonyi (Inst. for Theoretical Electricity of the Polytechnical Univ., Budapest). Periodica Polytechnica 1, No. 1, 73-88(1957).

The value of multiplication to be obtained in static neutron-multiplying systems using different quantities of variously enriched fissionable material and several types of geometrical layouts and reflectors is calculated. The economic and safety aspects of these systems are also considered. In the second part the problems relating to the application of neutron sources varying with time will be dealt with. (auth)

**12266**

CHARACTERISTICS OF THE HIGH FLUX REACTOR. M. Bustraan. Reactor Centrum Nederland 1, 45-8(1957) Sept. (In Dutch)

This article describes briefly the high flux reactor located at the Netherlands Reactor Center and the application of this reactor as a research tool. (L.T.W.)

**12267**

AN INTRODUCTION TO REACTOR PHYSICS. D. J. Littler and J. F. Raffle. New York, McGraw-Hill Book Co., Inc., 1957. 217p.

As much of nuclear physics is included as is required for an understanding of the principles involved in the construction of a reactor. The calculations used in evaluating the critical size of a gas-cooled, graphite moderated, natural U reactor are shown in detail. Sufficient reactor theory is given for an understanding of the problems involved in designing reactors of other types. The special subjects of shielding and instrumentation for a reactor, and the damage done to structural materials when subjected to high radiation fluxes are included. New material has been added to this revised edition in the sections on neutron interactions with matter, neutron diffusion, the procedure for determining the Laplacian of an assembly, and the neutron spectra in reactors. (M.H.R.)

## NUCLEAR TRANSFORMATION

**12268** UCRL-3858

California. Univ., Berkeley. Radiation Lab. FISSION AND SPALLATION COMPETITION IN $Ra^{226}$, $Th^{230}$, $U^{235}$ AND $Np^{237}$ (thesis). Robert Vandenbosch. July 1957. 85p. Contract W-7405-eng-48. $13.80(ph OTS); $4.80(mf OTS).

A radiochemical study of fission and spallation products produced by bombardment of $U^{235}$ with 18- to 46-Mev He ions and of the spallation products produced by 8- to 24-Mev deuteron bombardments of $Np^{237}$ has been made. Fission yield curves show an increase in symmetry with energy and become symmetric at about 40 Mev. Total reaction cross sections, including both fission and spallation reactions, indicate a nuclear radius parameter of slightly larger than $r_0 = 1.5 \times 10^{-13}$ cm for He-ion induced reactions of $U^{235}$. The excitation functions for the $(\alpha,n)$, $(\alpha,p)$, $(\alpha;p2n + \alpha,dn+\alpha,t)$, (d,p), and (d,p2n + d,dn+d,t) reactions are discussed in terms of direct interaction mechanisms involving little competition from fission. Comparison of the $(\alpha,2n)$ and $(\alpha,3n)$ excitation functions of $U^{235}$ and the (d,2n) and (d,3n) excitation functions of $Np^{237}$ verify Bohr's prediction that the breakup of the compound nucleus is independent of the manner in which it is formed. A model that takes into account the effect of fission competition on neutron evaporation in compound nucleus reactions is presented. Calculations based on this model show good agreement with those features of the $(\alpha,xn)$ reactions believed to result from compound nucleus formation. The results obtained from this model indicate that, for He-ion induced fission of $U^{235}$, fission usually precedes neutron evaporation. Excitation functions for the $(\alpha,4n)$ reactions of $Ra^{226}$, $Th^{230}$, and $U^{236}$ have been measured. These results and other reported cross sections for $(\alpha,4n)$ reactions in the heaviest elements have been analyzed in terms of fission and neutron-emission competition to obtain mean values of $\Gamma n/\Gamma f$. These mean values of $\Gamma n/\Gamma f$ have been successfully correlated with nuclear type, neutron binding energies, and the fissionability parameter $Z^2/A$. A study of the decay properties of $Pu^{237}$ is appended. (auth)

**12269**

BRANCHING RATIO FOR SLOW NEUTRONS. Madan Lall Sehgal (Muslim Univ., Aligarh). Indian J. Phys. 31, 329-31 (1957) June.

A study of slow neutron reaction with $B^{10}$ has been made with $BF_3$ proportional counters. The relative probability of the reactions $B^{10}$ $(n,\alpha)$ $Li^7$ and $B^{10}$ $(n,\alpha)$ $Li^{*7}$ is determined by measurements with and without cadmium cap. (auth)

**12270**

ON THE NEUTRONS FROM THE $N^{14}$ (d, n)$O^{15}$ REACTION-II. Itaru Nonaka, Susumu Morita, Nawoyuki Kawai, Toshiyuki Ishimatsu, Kenji Takeshita, Yutaka Nakajima, and Nawoyuki

Takano (Dept. of Physics, Faculty of Science, Kyushu Univ., Fukuoka, Japan). J. Phys. Soc. Japan 12, 841-5(1957). Aug.

The angular distribution of neutrons from the $N^{14}(d, n)O^{15}$ reaction leading to $O^{15}$ ground state was investigated in the angular range from 0 to 165° (lab. system) by the photographic method. The energy of the bombarding deuterons was 1.96 Mev, and the Q-value was found to be $Q_0 = (5.13 \pm 0.05)$ Mev. The angular distribution shows a maximum at about 30° (c.m.s.) and decreases considerably beyond this maximum, in accordance with what is characteristic to the stripping process corresponding to $l_p = 1$. In the backward direction, the intensity of neutrons increases remarkably and reaches the value almost three times as large as that of the forward maximum. The absolute cross section of this reaction was estimated to be $\sigma(0°) = (2.4 \pm 0.7)$ mb/sterad. and $\sigma = (38 \pm 7)$ mb. (auth)

**12271**

THE MECHANISM OF THE REACTION $^{16}O(\gamma,4\alpha)$. B. Čujec-Dobovišek. "J. Stefan" Inst. Repts. (Ljubljana) 3, 61-77(1956) Oct.

The mechanism of the reaction $O^{16}(\gamma, 4\alpha)$ has been investigated on the basis of 142 stars induced in nuclear emulsions by the bremsstrahlung of maximum energy 32 Mev. A distinct change in the mechanism with the photon energy of about 24 Mev has been observed. At E < 24 Mev the reaction proceeds in about half the cases via the 9.6 and 10.8 Mev levels of $C^{12}$, and via the ground level of $Be^8$. For the remaining half of the cases it has not been possible to determine the mechanism uniformly. We may accept the interpretation that the reaction proceeds via the 12.76 Mev level of $C^{12}$, and the 3 Mev level of $Be^8$, but a direct disintegration into four alphas is as well possible. At $E_\gamma >$ 24 Mev, the reaction proceeds in 80 to 90% via the 16.1 Mev level of $C^{12}$, and the 3 Mev level of $Be^8$, whereas the remaining 10 to 20% involve a $Be^8$ ground-state nucleus. Angular distributions and correlations in the transitions to the 16.1 Mev level of $C^{12}$, and the 3 Mev level of $Be^8$ have been determined, and partially compared with the theoretical ones. The change in the mechanism at $E_\gamma = \sim 24$ Mev is interpreted according to the isotopic spin selection rules. (auth)

**12272**

COULOMB CORRECTIONS IN ALLOWED BETA TRANSITIONS. J. D. Jackson, S. B. Treiman, and H. W. Wyld, Jr. (Princeton Univ., N. J.). Nuclear Phys. 4, 206-12(1957) Aug.

Complete expressions, with all Coulomb effects taken into account, are given for the distribution functions for allowed beta decay, including recoil, nuclear orientation, and electron polarization effects. The expressions are general in that no assumptions are made as to invariance with respect to space inversion, charge conjugation, or time reversal. Simple arguments based on the behavior of the various momenta and angular momenta under space inversion and time reversal are used to elucidate which combinations of vectors will appear when the different symmetry laws are violated, and the modifications of these arguments necessary because of the Coulomb interaction in the final state are pointed out. Various tests of time reversal invariance, previously suggested, are re-evaluated in view of the results for the Coulomb corrections. (auth)

**12273**

FURTHER REMARKS ON COULOMB CORRECTIONS IN ALLOWED BETA TRANSITIONS. M. E. Ebel and G. Feldman (Univ. of Wisconsin, Madison). Nuclear Phys. 4, 213-14(1957) Aug.

An independent calculation, similar to one given by Jackson, Treiman, and Wyld, has been carried out. The terms which were not included in that calculation are added for the sake of completeness. These terms are those which require the simultaneous measurement of nuclear orientation, recoil and electron polarization and/or its momentum. (M.H.R.)

**12274**

INDIVIDUAL PARTICLE AND COLLECTIVE ASPECTS OF THE NUCLEAR PHOTOEFFECT. D. M. Brink (Massachusetts Inst. of Tech., Cambridge). Nuclear Phys. 4, 215-20 (1957) Aug.

The coordinate corresponding to the dipole photon absorption operator is exactly separable in the oscillator shell model. It is shown that in an electric dipole absorption a mode of the shell model is excited in which the protons vibrate against the neutrons. In shell models other than the oscillator model this collective mode is damped; in heavy nuclei this damping gives a line width of ≈4 Mev. (auth)

**12275**

AN ALPHA-PARTICLE MODEL FOR THE NUCLEAR PHOTODISINTEGRATION OF $O^{16}$. Hans Wilhelmsson and Margita Nilsson (Univ. of Lund). Nuclear Phys. 4, 234-9 (1957) Aug.

The photonuclear effect in $O^{16}$ is studied theoretically for the case of one emitted nucleon. The giant resonance is described with the aid of a simple model, which assumes that in the $O^{16}$ nucleus only four nucleons, forming an $\alpha$ particle, are affected by the $\gamma$ ray. The $\alpha$ particle is assumed to be moving in a static collective potential from the other nucleons, these being undisturbed during the photodisintegration process. Gaussian wave functions are used. The results obtained are not in disagreement with recent experimental information. (auth)

**12276**

NOTE ON THE $(\gamma, d)$ REACTIONS. J. Sawicki (Univ. of Warsaw) and W. Czyz (Polish Academy of Sciences Dept. of Cracow). Nuclear Phys. 4, 248-56(1957) Aug.

The large observed ratios of $(\gamma,d)$ to $(\gamma,p)$ cross-sections are explained in terms of a two-stage mechanism of the $(\gamma,d)$ process from the point of view of the nuclear shell model. The incident photon is assumed to be absorbed by a single nucleon which in its turn picks up another nucleon within the nucleus with the right momentum to form an outgoing deuteron. The method of calculation of $\sigma(\gamma,d)/\sigma(\gamma,p)$ in a general case is presented. The example of the $S^{32}(\gamma,d)P^{30}$ reaction is discussed. The importance of investigating $(\gamma,d)$ angular distributions is indicated. (auth)

**12277**

THEORY OF THE DIFFERENTIAL CROSS SECTION OF (d, pn)-STRIPPING REACTIONS. Otto Hittmair. Publs. com. nacl. energia atomica (Buenos Aires) Ser. fis. 1, 203-15(1957). (In Spanish)

The differential cross section of a (d, pn)-stripping reaction is calculated in general form. The directional observation of the outgoing neutron provides more complete information on the stripping spins and angular momenta than can be gained from the (d, p)-reaction alone. The (d, pn)-angular distribution furnishes information on shell model coupling which can be checked against observed nuclear energy levels. The symmetry properties of the distribution manifest clearly whether the reaction proceeds by pure stripping or also by compound nucleus formation. The distribution for the $Li^7$ (d, pn) $Li^7$-reaction is calculated as an example. (auth)

**12278**

REACTIONS INFREQUENTLY OBSERVED BY IRRADIATION OF SILICON WITH NEUTRONS. R. H. Rodriguez

Pasques. Publs. com. nacl. energia atomica (Buenos Aires) Ser. quim. 1, 81-9(1957). (In Spanish)

Silicon was bombarded with fast neutrons, and some of the resulting products were investigated, $Na^{24}$ and $Mg^{28}$ being identified among them. The latter can be produced either by the reaction (n, 2p) or (n, $He^3$), or both. The formation of $Na^{24}$ can be attributed to an (n, $\alpha$p) process; it is experimentally proved that the neutron capture contribution to the production of the sodium isotope is very poor. Energy computations related to these nuclear reactions are given. (auth)

## PARTICLE ACCELERATORS

**12279** MURA-321

Midwestern Universities Research Assn., Madison, Wis.
QUARTERLY REPORT TO THE ATOMIC ENERGY COMMISSION FOR THE PERIOD APRIL 1, 1957 TO JUNE 30, 1957. July 1, 1957. 13p. $0.50(OTS).

Experimental work is reported in magnetic field measurement techniques, r-f tests with the radial sector model, and assembly of the spiral sector model parts. Work of the theoretical and computer divisions is briefly summarized. (For preceding period see MURA-281.) (T.R.H.)

**12280** UCRL-1651(Rev. 3)

California. Univ., Berkeley. Radiation Lab.
INDEX TO INFORMATION AVAILABLE ON THE CROCKER 60-INCH CYCLOTRON. July 11, 1957. 13p. Contract W-7405-Eng-48. $3.30(ph OTS); $2.40(mf OTS).

A list of reports and engineering notes on the various phases of the development and operation of the Crocker 60-in. cyclotron is presented. (J.E.D.)

**12281** UCRL-2426(Rev.)

California. Univ., Berkeley. Radiation Lab.
HIGH-ENERGY PARTICLE DATA. VOLUME II. John H. Atkinson, Jr. and Beverly Hill Willis. June 1957. 92p. Contract W-7405-eng-48. $0.50(OTS).

Range-energy and range-momentum curves are given for electrons, $\pi$, $\mu$, and K mesons, protons, $\Sigma$ and $\Xi$ hyperons, deuterons, and $\alpha$ particles. A miscellaneous collection of supplemental data useful to the experimenter is included. (M.H.R.)

**12282**

SOME FEATURES OF REGENERATIVE DEFLECTION AND THEIR APPLICATION TO THE HARVARD SYNCHROCYCLOTRON. G. Calame, P. F. Cooper, Jr., S. Engelsberg, G. L. Gerstein, A. M. Koehler, A. Kuckes, J. W. Meadows, K. Strauch, and R. Wilson (Harvard Univ.). Nuclear Instr. 1, 169-82(1957) July.

The regenerative deflector system applied to the Harvard synchrocyclotron is described. The theory of LeCouteur has been extended to include the initial radial oscillations, and it is shown, both theoretically and experimentally, that only partial monochromatization of the beam occurs during regeneration. However, it is possible to internally limit the energy width of the regenerated beam at the expense of intensity. The theory is in good accord with experiment. The application of these results to the production of an intense external proton beam and more monoenergetic neutron and polarized proton beams is described. (auth)

**12283**

LOW-ENERGY MESON BEAM FROM CYCLOTRON. Donald Koppel, Robert Bingham, and E. T. Booth (Columbia Univ., New York). Rev. Sci. Instr. 28, 645-6(1957) Aug.

For experimental purposes an external meson beam of as low as 31 ± 2.5 Mev kinetic energy has been obtained from the Nevis 385-Mev cyclotron by the use of a steel magnetic shield between the vacuum chamber and the concrete shielding. This has been achieved with comparatively little loss of intensity over that obtained at 63-Mev mean energy of mesons obtained through the same hole in the concrete shield without the use of the magnetic shielding. (auth)

## RADIATION ABSORPTION AND SCATTERING

**12284** AECU-3527

Westinghouse Electric Corp. Research Labs., [East] Pittsburgh, Penna.
COMPILATION OF TECHNICAL REPORTS ON THE SUBJECT OF FAST NEUTRON SCATTERING. PART III. [1957]. 117p. Project NR-024-028. Sponsored by ONR and AEC under Contract N6-ORL-156, task 2. $18.30(ph OTS); $6.00(mf OTS).

Part I issued as AECU-3387. Part II issued as AECU-3402.

The papers presented are entitled: Resonance Capture Integrals as a Check on the Neutron Absorption Cross Section in Multigroup Tabulations; Multigroup Neutron Cross Sections; Cross Section Calculations for Fast Neutron Scattering; IV. Depth and Radius of the Real Potential in a Diffuse Surface Optical Model; and The Construction of Inelastic Scattering Matrices. (T.R.H.)

**12285** ORNL-2196

Oak Ridge National Lab., Tenn.
ENERGY AND ANGULAR DISTRIBUTION OF GAMMA RADIATION FROM A $Co^{60}$ SOURCE AFTER DIFFUSION THROUGH MANY MEAN FREE PATHS OF WATER. R. W. Peele, F. C. Maienschein, and T. A. Love. Sept. 6, 1957. 31p. Contract W-7405-eng-26. $0.25(OTS).

Measurements were made of the energy and angle spectrum of the photon energy flux resulting from 1.17- and 1.33-Mev gamma rays from a point source after diffusion in an infinite water medium. Energy flux spectra were measured for penetration distances corresponding to approximately six and nine mean free paths for the uncollided source photons and for angles of gamma-ray emission varying from 0 to 90°. Spectral measurements were made with a Compton spectrometer having a peak-to-total ratio of 0.7 and a resolution of 14% (full width at half maximum) for 1.12-Mev photons. The resulting energy and angle spectra of the energy flux are compared, after integration over angle, with calculated results which have been obtained by the "moments method." The results are also compared with the available calculated differential results. (auth)

**12286**

THE ELASTIC AND INELASTIC SCATTERING OF POLARIZED PROTONS BY CARBON. J. M. Dickson and D. C. Salter (Atomic Energy Research Establishment, Harwell, Berks). Nuovo cimento (10) 6, 235-41(1957) July.

**12287**

ABSORPTION COEFFICIENTS OF $Co^{60}$ GAMMA RAYS. A. M. Ghose and N. K. Ganguly. Trans. Bose Research Inst. Calcutta 19, 141-53(1953-55).

Absorption cross section of $Co^{60}$ gamma rays for different absorbers have been measured using Geiger-Müller counters as detectors. An analysis has been made of the errors present in this type of experiment, caused by the scattered radiations entering the detector system. By eliminating these sources of errors, a condition was obtained in which the expected accuracy of the results was within 0.5%. Theoretical cross sections for photoelectric, pair creation, and Compton cross-sections have been computed for Co $\gamma$ rays. The measured values of cross-sections agree with

the theoretical values within 1% for Cu and I, within 2% for Pb, Al and O. Bromine shows a deviation of 2.4 percent, which necessitates re-evaluation of the cross-section. In this connection the following factor influencing the results is to be considered. The absorption cross-sections measured in this experiment were the composite cross sections in which the contributions of both the gamma rays emitted by $Co^{60}$ source were involved. The theoretically expected values were computed by taking the efficiency of the detector proportional to the $\gamma$ ray energy. (auth)

## RADIATION EFFECTS

**12288** NMI-1172

Nuclear Metals, Inc., Cambridge, Mass.

SEMI-ANNUAL PROGRAM REPORT TO THE AEC RESEARCH DIVISION FOR THE PERIOD ENDING DECEMBER 31, 1956. Feb. 26, 1957. 12p. Contract AT(30-1)-1565. $3.30(ph OTS); $2.40(mf OTS).

Brief summaries of progress in studies of tandem extrusion, radiation effects on precipitation-hardening alloys, and evaporation from the surface of irradiated metal are given. (For preceding period see NMI-1170.) (T.R.H.)

**12289** UCRL-4888

California. Univ., Livermore. Radiation Lab.

BIBLIOGRAPHY: PART I. EFFECTS OF NUCLEAR RADIATION UPON ELECTRONIC AND ELECTRICAL COMPONENTS. PART II. ELECTRONIC AND ELECTRICAL COMPONENTS FOR CRITICAL ENVIRONMENTS. Frederick E. Frost. Apr. 30, 1957. 16p. Contract W-7405-eng-48. $3.30(ph OTS); $2.40(mf OTS).

This bibliography consists of references pertaining to Effects of Nuclear Radiation Upon Electronic and Electrical Components, and to Electronic and Electrical Components for Critical Environments. References were compiled from the classified and unclassified report literature and the published literature. The following indexes and abstract journals were used: Weapons Data Index, AEC Card Catalog, Engineering Index (1950-55), and Office of Technical Services, Research Reports (1956-March 1957). The references are divided into published literature and report literature. Arrangement is by author for the published literature and by report number for the report literature. The security classification of the reports is given. (auth)

**12290**

IMPERFECTIONS IN THE STRUCTURE OF NEUTRON-IRRADIATED LiF: REASSEMBLING OF INTERSTITIAL ATOMS. Marianne Lambert and André Guinier. Compt. rend. 245, 526-9(1957) July 29. (In French)

**12291**

EXPANSION OF LiF UNDER NEUTRON IRRADIATION. D. Binder and W. J. Sturm (Oak Ridge National Lab., Tenn.). Phys. Rev. 107, 106-7(1957) July 1.

The strain gage method is applied to the relative linear expansion of LiF under neutron irradiation. The result is $(9.9 \pm 0.3) \times 10^{-6}$ per $10^{15}$ thermal neutrons. An estimate of the number of displacements is in adequate agreement with theory. (auth)

## RADIOACTIVITY

**12292**

GAMMA SPECTRA OF THE RADIOACTIVE FALL-OUT FROM THE ATMOSPHERE. W. Herbst and K. Sommermeyer. Naturwissenschaften 44, 392(1957). (In German)

**12293**

ON THE POLARIZATION OF ELECTRONS IN $\beta$-DECAY. M. E. Vishnevsky, V. K. Grigoriev, V. A. Ergakov, S. J. Nikitin, E. V. Pushkin, and Yu. V. Trebukhovsky (U.S.S.R. Academy of Sciences, Moscow). Nuclear Phys. 4, 271-2 (1957) Aug.

In order to observe longitudinal polarization, the electrons emitted by $Cu^{64}$ were deflected in an electric field of a cylindrical condenser, and the azimuthal asymmetry corresponding to an electron polarization opposite to the direction of momentum (right-left asymmetry) was observed. The value of this asymmetry for two different arrangements was found to be $0.35 \pm 0.05$ and $0.27 \pm 0.05$ respectively, which is in qualitative agreement with the theoretical value of 0.34. (M.H.R.)

**12294**

THE DECAY OF $^{185}W$. I. R. Williams and M. W. Johns (McMaster Univ., Hamilton, Can.). Nuovo cimento (10) 6, 18-22(1957) July.

The decay of $W^{185}$ has been studied with a magnetic $\beta$-ray spectrometer. The $\beta$ spectrum and the electron spectrum from a cadmium converter have been examined down to electron energies of 30 kev. The ground state $\beta$ spectrum has an allowed shape and an end-point of $(430 \pm 4)$ kev. Since no evidence is found for either internal conversion electrons or $\gamma$ rays associated with 55.6 or 125 kev transitions in $Re^{185}$, it is concluded that $\beta$ transitions to such levels do not exist with branching ratios greater than $1.5 \cdot 10^{-2}$ and $9 \cdot 10^{-4}$, respectively. (auth)

**12295**

A GRAPHICAL METHOD FOR THE DETERMINATION OF HALF-LIVES. I. Kuščer and M. V. Mihailović (Inst. of Physics, Ljubljana, Yugoslavia) and E. C. Park (Univ. of Birmingham, Eng.). Phil. Mag. (8) 2, 998-1002(1957) Aug.

The graphical determination of half lives of radioactive isotopes can be made more accurate if the remaining number of counts, instead of the counting rate, is plotted as a function of time. This method has been used to measure the half life of $Si^{27}$, for which the value $4.14 \pm 0.03$ seconds has been obtained. (auth)

**12296**

THE TECHNICAL APPLICATIONS OF RADIOACTIVITY. 2. REVISED EDITION. Engelbert Broda and Thomas Schönfeld. Berlin, VEB Publishing House, 1957. 321p. (In German)

## RARE EARTHS AND RARE-EARTH COMPOUNDS

**12297**

STUDIES OF LUMINESCENCE SPECTRA IN RARE-EARTH DIFFUSION INTO VARIOUS CRYSTALS. A. K. Trofimov. Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 21, 757-60(1957) May. (In Russian)

The luminescence spectra of Eu and Sm diffusion into various mechanical mixtures of crystalline phosphor dusts and pure base were studied by sintering the mixtures at various temperatures. A table is presented of the crystalline chemical characteristics of compounds of $CaF_2$, $SrF_2$, $BaF_2$, $CaSO_4$, $Ca_3(PO_4)_2$, $ThO_2$, $CaMoO_4$, $CaWO_4$, $LaF_3$, $La_2O_3$, and $SnO_2$. In all investigated cases the Eu and Sm behaved identically during the diffusion into various crystals at the selected temperatures of 100 to 1300°. The crystalline structures of $ThO_2$, $CaMoO_4$, $LaF_3$, $SnO_2$, $CaWO_4$, and $La_2O_4$ proved to be good acceptors of rare-earth activators. (R.V.J.)

**12298**

HEAT CAPACITY OF HOLMIUM FROM 15 TO 300°K.

B. C. Gerstein, Maurice Griffel, L. D. Jennings, R. E. Miller, R. E. Skochdopole, and F. H. Spedding (Iowa State Coll., Ames). J. Chem. Phys. 27, 394-9(1957) Aug.

The heat capacity of holmium has been measured over the range 15 to 300°K. Two maxima have been observed which occur at 19.4 and 131.6°K. The one at the lower temperature exhibits a dependence on the thermal history of the sample and this dependence was investigated. The thermodynamic functions have been tabulated and a correlation made of the contributions to the entropy at room temperature. The value of $S^{0}_{298.16}$ is 17.97 cal $(°K)^{-1}$ $(g\ atom)^{-1}$ to which the magnetic contribution is $R \ln(2J + 1)$. (auth)

**12299**

ON URANYL AND THORIUM SELENITES. E. I. Krylov and V. G. Chukhlantsev (Kirov Ural Polytechnical Inst., Sverdlovsk). Zhur. Analit. Khim. 12, 451-6(1957) July. (In Russian)

The pH range has been found for the precipitation of uranyl and thorium selenites from sulfuric acid and nitric acid solutions. The solubility products at 20° are calculated from the value of solubility in acids: $S = (UO_2^{2+}) \times (SeO_3^{2-}) = 3.8 \times 10^{-11}$ and $S = (Th^{4+}) \times (SeO_3^{2-})^2 = 1.35 \times 10^{-30}$. (tr-auth)

## SHIELDING

**12300**

CONCRETE IN RADIATION SHIELDING TECHNIQUE. Thomas Jaeger. Atomkern Energie 2, 255-62(1957) July. (In German)

## SPECTROSCOPY

**12301** SCL-T-133

A LIGHT ARC FOR HIGH POWER OUTPUTS. (Ein Lichtbogen für hohe Leistungen). H. Maecker. Translated from Z. Physik, 129, 108-22(1951). 21p.

This paper describes a light arc which burns in the well defined channel of a water vortex. The load capacity of this arc is extraordinarily high. The following extreme conditions could be realized until now: channel diameter 1.4 mm, length 13 mm, current intensity 250 amp, field intensity 240 v/cm, power output for 1 cm column length 60 kw/cm, temperature 35,000°K, current density 17,000 amp/cm$^2$. The temperature and determination of the electron pressure can be effected by means of measuring a spectrum line. This and other reasons make the arc particularly suitable for spectroscopic measurements. If one uses a perforated plate as an electrode, then the heated plasma goes from the channel through the plate aperture and forms a non-conducting, closed plasma beam many centimeters long, which is of interest for plasma research. (auth)

**12302**

VIBRATIONAL SPECTRUM AND STRUCTURE OF METAL-CYANIDE COMPLEXES IN THE SOLID STATE. II. $KAu(CN)_2$. Llewellyn H. Jones (Los Alamos Scientific Lab., N. Mex.). J. Chem. Phys. 27, 468-72(1957) Aug.

The infrared spectra of solid $KAu(CN)_2$ and the mono- and di-substituted $C^{13}$ and $N^{15}$ species have been observed. The seven fundamental vibrations of the linear, symmetrical $Au(CN)_2^-$ ion have been assigned at 2160, 452, 2141, 427, 305, 368, and 100 cm$^{-1}$. From the observed frequencies of the normal and isotopic species, force constants were calculated for two possible structures: N–C–Au–C–N and C–N–Au–N–C. It is shown that the latter structure gives unreasonably large values for the CN stretching force constant and the CN, AuN interaction constant, and that therefore the cyanides are most likely bound to the gold through the carbon atoms. (auth)

**12303**

FUNDAMENTAL OF $N^{15}O$. W. H. Fletcher and G. M. Begun (Oak Ridge National Lab., Tenn.). J. Chem. Phys. 27, 579-82(1957) Aug.

The fundamental vibration-rotation band of $N^{15}O$ has been examined with a grating spectrometer. The molecular constants obtained are in good agreement with existing data and the isotope relations. (auth)

**12304**

ACHIEVEMENTS IN NUCLEAR SPECTROSCOPY. Yu. V. Khol'nov. Vestnik Akad. Nauk S.S.S.R. 27, No. 5, 105-7 (1957) May. (In Russian)

Developments in theoretical and experimental nuclear spectroscopy were discussed during the conference of the Academy of Science, Physico-Mathematical Dept., in Leningrad, Jan. 25-31, 1957. (R.V.J.)

## THEORETICAL PHYSICS

**12305** NBS-5046

National Bureau of Standards. Cryogenic Engineering Lab., Boulder, Colo.

ORTHO-PARA CATALYSIS IN LIQUID–HYDROGEN PRODUCTION. Technical Memorandum No. 45. D. H. Weitzel, J. W. Draper, W. V. Loebenstein, and O. E. Park. Feb. 15, 1957. 21p. NBS Project 8120-12-8629. $3.30 (ph OTS); $2.40(mf OTS).

A series of selected or specially prepared catalysts were studied for their ability to accelerate the ortho to para conversion of hydrogen. The results are presented, and the various catalysts are compared in performance with chromic oxide on alumina pellets. An outstanding catalyst in the form of unsupported hydrous iron oxide granules was selected for further study and use in the Cryogenic Engineering Laboratory liquefiers. One and one-half liters of this catalyst have now been used to convert more than 50,000 liters of liquid hydrogen to 90 to 95% para at an average rate of about 235 liquid liters per hr. There is to date no evidence of decrease in efficiency with continued use. (auth)

**12306**

ON FOUR-DIMENSIONAL ISOBARIC SPIN FORMALISMS. P. W. Higgs (Univ. Coll., London). Nuclear Phys. 4, 221-3 (1957) Aug.

It is shown that the use of a four-dimensional isobaric spin space with an indefinite metric is inconsistent with the probability definitions of quantum mechanics. (auth)

**12307**

THE ENERGY LOSS OF FAST CHARGED PARTICLES. PART III. D. A. Tidman (Univ. of Sydney). Nuclear Phys. 4, 257-70(1957) Aug.

Formulas for a quantum treatment of the energy loss of a fast charged particle and the density effect have previously been obtained. The present paper investigates these numerically, comparing their predictions with experiment for the case of oxygen. Good agreement is obtained. (auth)

**12308**

THE THEORY OF THE VAVILOV-CHERENKOV EFFECT. B. M. Bolotovskiĭ. Uspekhi Fiz. Nauk 62, 201-46(1957) July. (In Russian)

A review is given of the Vavilov-Cherenkov effect in isotopic media and crystals. The Vavilov-Cherenkov radiation in the atmosphere, in ferromagnetics, or the ef-

fects of multiple scattering on the angular width in the Vavilov-Cherenkov radiation are not discussed. The duration of the burst in the Vavilov-Cherenkov effect, the conversion of the effect, and other related subjects are briefly described. 216 references. (R.V.J.)

## URANIUM AND URANIUM COMPOUNDS

**12309** NAA-SR-1989

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

DECONTAMINATION OF THORIUM–URANIUM ALLOY BY NONCONSUMABLE ELECTRODE ARC-MELTING. E. W. Murbach and A. G. Buyers. Sept. 1, 1957. 14p. Contract AT-11-1-GEN-8. $0.20(OTS).

The evaporation of fission products from Th–U alloy by melting in an electric arc was investigated. Effective removal of Cs and Sr was observed while the rare earths were partially removed and the refractory metals remained in the alloy. Uranium and Pa are vaporized when heated at high temperatures and for long periods. There is an indication that a consumable melting process is reasonably suitable as a high temperature method for decontaminating Th fuels. (auth)

**12310**

POLAROGRAPHIC BEHAVIOR OF THE URANYL-CUPFERRON SYSTEM. Philip J. Elving and Alan F. Krivis (Univ. of Michigan, Ann Arbor). Anal. Chem. 29, 1292-7 (1957) Sept.

Unusual current and potential phenomena disclosed in a previous polarographic examination of the uranyl-cupferron system in 10% $H_2SO_4$ solution prompted the present more detailed investigation. The technique essentially involved polarographing series of solutions in which the concentration of one of the active species was held constant as the other was varied. Other pertinent experimental factors were also examined. At low concentrations of both uranium and cupferron two waves appear, corresponding to U(VI)–U(V) and cupferron-phenylhydrazine reductions. The variations in height and in $E_{\frac{1}{4}}$ of these two waves with increasing uranium and cupferron concentrations are basically related to the formation of an insoluble film of U(IV) cupferrate at the Hg surface. Presence of such a film hinders the approach of uranyl ions to the electrode, facilitates the reduction of U(VI) past U(V) to U(IV), converts cupferron to more difficultly reducible cupferrate, and affects the capillary electrode performance depending on the size of its lumen. The formation of the film postulated was verified by experiments in the presence of a known solvent for U(IV) cupferrate. (auth)

**12311**

THE LUMINESCENCE OF TRI-VALENT URANIUM. L. N. Galkin and P. P. Feofilov. Doklady Akad. Nauk S.S.S.R. 114, 745-7(1957) June 1. (In Russian)

Intensive luminescence spectra in the infrared region near 2.0 to 2.5$\mu$ were discovered during the investigation of monocrystals of $CaF_2$, $SrF_2$, and $BaF_2$ with 0.1 to 0.3% U prepared under highly reducible conditions. The crystals were strongly colored red ($CaF_2$), orange-red ($SrF_2$), and orange ($BaF_2$). The absorption spectra and luminescence of $CaF_2$–U 0.25% measured at room temperature were quite intensive and had a series of bands in the 2.1 to 2.5$\mu$ region. The luminescence spectra for $SrF_2$(U) and $BaF_2$(U) were also found in the same region; however they differed in structural details. There are reasons to consider the luminescence to be the luminescence of trivalent ions of $U^{3+}$. (R.V.J.)

**12312**

THE ENERGY DEPENDENCE OF THE FISSION-NEUTRON YIELD PER NEUTRON ABSORBED IN $U^{233}$ OVER THE RANGE 0.025-2.2 eV. J. E. Sanders, H. M. Skarsgard, and C. J. Kenward (Atomic Energy Research Establishment, Harwell). J. Nuclear Energy 5, 186-91(1957).

The energy dependence of $\eta$, the fission neutron yield per neutron absorbed in $U^{233}$, has been measured from 0.025 to 2.2 ev using a crystal spectrometer. Up to 1.3 ev $\eta$ was found to remain within ± 2% of its value at thermal energies, above 1.3 ev $\eta$ decreases, and at 2.16 ev has fallen to 80% of its thermal value. (auth)